

UGANDA PROTECTORATE.

ANNUAL REPORT



OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

YEAR ENDED 31ST DECEMBER, 1929.

PRICE: Shs. 4.

Published by Command of His Excellency the Governor.



ENTEBBE:

PRINTED BY THE GOVERNMENT PRINTER, UGANDA,
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Addresses of Officers and Telephone Numbers:

						<i>P.O. Box</i>	<i>Telephone</i>
						<i>No.</i>	<i>No.</i>
DIRECTOR OF AGRICULTURE	...	...	...	Kampala	...	281	189
HEAD OFFICE	...	...	...	Kampala	...	281	15
AGRICULTURAL LABORATORY AND KAMPALA PLANTATION				Kampala	...	5	18
BOTANIC GARDENS AND METEOROLOGICAL OFFICE	...			Entebbe	...	60	38
JINJA OFFICE	...	...	...	Jinja	...	67	22

PRINCIPAL EXPERIMENTAL STATIONS.

- (1) Kampala. (2) Serere, Teso. (3) Bukalasa, Mengo.
The Botanic Gardens, Entebbe.

SUBSIDIARY STATIONS.

- (1) Ngetta, Lango. (3) Buwunga, Masaka.
(2) Fort Portal, Toro. (4) Kakumiro, Mubende.
(5) Bugusege, Bugishu.

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STAFF LIST.

<i>Director of Agriculture</i>	...	...	J. D. TOTHILL, D.SC. (HARVARD), B.SC. (TORONTO) (from June 26th).
<i>Deputy Director of Agriculture</i>	...	...	L. HEWETT, M.R.A.C.
<i>Statistician</i>	...	...	H. G. SMITH.
<i>Office Superintendent</i>	...	...	G. A. READ.
<i>Clerk</i>	...	...	A. J. DOWSE.

GENERAL DIVISION.

<i>Senior Agricultural Officers</i>	...	...	A. R. MORGAN. G. F. CLAY, M.C., B.SC. (EDIN.), N.D.A., N.D.D. (HONS.).
<i>Superintendent of Agricultural Education</i>	...	...	E. G. STAPLES, M.A., M.R.A.C., DIP. AGRIC. (CANTAB.).
<i>Agricultural Officers</i>	...	...	J. D. SNOWDEN. R. T. WICKHAM. C. E. J. BIGGS, B.SC. (LOND.), DIP. AGRIC. (WYE). D. STEDMAN-DAVIES, B.SC. (WALES). A. B. KILLICK, B.SC. (LOND.), DIP. AGRIC. (WYE). N. S. HAIG, B.SC. (LOND.), DIP. AGRIC. (WYE). E. F. MARTIN, DIP. AGRIC. (HARPER ADAMS AND NORTHANTS).
<i>Agricultural Officers (Education)</i>	...	...	C. W. L. FISHLOCK, B.SC. (LOND.), B.SC. (READING), A.I.C.T.A. (from October 23rd). R. W. STUCKEY, M.A. (CANTAB.), B.S.A. (MCGILL), A.I.C.T.A. (from November 7th).
<i>Coffee Officer</i>	...	...	W. L. MUNN.
<i>Cotton Grader and Ginning Inspector</i>	...	...	MAJOR N. G. WRIGHT.
<i>Plantation Managers</i>	...	...	G. T. PHILPOTT. F. W. HALL (to July 6th). CAPT. J. S. HARMSWORTH, M.C. C. HAZEL. P. CHANDLER. E. A. RUCK.
<i>Ploughing Instructors</i>	...	...	A. L. STEPHENS. G. H. THOMAS.

AGRICULTURAL LABORATORIES.

<i>Entomologist</i>	...	...	H. HARGREAVES, A.R.C.S., D.I.C., F.E.S.
<i>Assistant Entomologist</i>	...	...	G. L. R. HANCOCK, M.A. (CANTAB.), F.E.S.
<i>Mycologist</i>	...	...	C. G. HANSFORD, M.A. (CANTAB.).
<i>Botanist</i>	...	...	L. C. C. LIEBENBERG, B.SC. (TRANS.), M.Sc. (MCGILL).
<i>Cotton Botanist</i>	...	...	G. W. NYE, B.SC. (LOND.), DIP. AGRIC. (WYE).
<i>Assistant Cotton Botanist</i>	...	...	H. R. HOSKING, B.SC. (LOND.), A.R.C.S.
<i>Agricultural Chemist</i>	...	...	W. S. MARTIN, Ph.D., M.Sc. (LOND.), A.R.C.S., D.I.C., A.I.C.

CLERICAL STAFF.

<i>Clerks</i>	...	...	J. C. S. DE SOUZA. A. S. REMEDIOS. M. A. S. MENEZES. F. C. DE SOUSA.
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NATIVE CIVIL SERVICE.

<i>Overseer</i>	...	...	KOSEA MUKASA.
<i>Clerk</i>	...	...	REUBEN SEMPAGALA.
<i>Laboratory Assistant</i>	...	...	YOANNA KAIKZI.

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT

FOR THE YEAR ENDED 31ST DECEMBER, 1929.

Staff.

The following appointments and movements took place during the year :—

DR. J. D. TOTHILL assumed duty as Director of Agriculture on July 1st.

MR. G. F. CLAY, Senior Agricultural Officer, went on leave on December 21st.

MR. E. G. STAPLES, Superintendent of Agricultural Education, returned from leave on February 17th.

MESSRS. WICKHAM AND BIGGS, Agricultural Officers, returned from leave on June 18th and December 30th respectively.

MR. N. S. HAIG, Agricultural Officer, went on leave on September 15th.

MESSRS. C. W. L. FISHLOCK and R. W. STUCKEY, Agricultural Officers (for Agricultural Education), arrived on first appointment on November 10th and December 3rd respectively.

MESSRS. G. T. PHILPOTT and E. A. RUCK, Plantation Managers, went on leave on July 6th and December 21st respectively.

MR. F. W. HALL, Plantation Manager, went on leave on July 6th prior to transfer to the Gambia on promotion as Assistant Director of Agriculture.

MR. A. L. STEPHENS, Ploughing Instructor, went on leave on June 21st.

MAJOR N. G. WRIGHT, Cotton Grader, and MR. W. L. MUNN, Coffee Officer, returned from leave on November 22nd.

MR. C. G. HANSFORD, Mycologist, and MR. G. W. NYE, Cotton Botanist, returned from leave on December 3rd.

MR. H. G. SMITH, Statistician, was appointed on March 1st.

MR. A. J. DOWSE, Clerk, arrived on first appointment on March 16th.

Exports.

2. The total value of domestic produce exported from the Protectorate during the year amounted to £4,274,755, compared with £3,395,267 for the preceding year. The value of ginned cotton exported amounted to £3,312,668, representing 204,057

bales and approximately 77·5% of the total exports. A table showing the details of exports for the year is given below, and comparative tables will be found in Appendices 6 and 7.

<i>Description.</i>		<i>Quantity.</i>	<i>Value</i> £	<i>Per cent.</i>
Cotton, raw	...	816,228 centals	3,312,667	77·5
Cotton seed	...	67,523 tons	424,000	9·9
Coffee, raw	...	41,192 cwts.	177,142	4·1
Hides (dry and dry salted)	...	35,099 cwts.	152,542	3·6
Tin ore	...	324½ tons	63,900	1·5
Rubber, plantation	...	8,231 centals	28,818	0·7
Chillies	...	6,174 cwts.	26,133	0·6
Simsim, seed	...	1,338 tons	24,890	0·6
Ivory	...	407 cwts.	24,757	0·6
Skins, sheep and goat	...	258,045 No.	12,901	0·3
Other exports	...	...	27,005	0·6
			<u>£4,274,755</u>	

Cotton.

3. The 1928/29 (*i.e.*, planted in 1928 and marketed in 1929) crop was the largest yet produced in the Protectorate, and amounted to 204,057 bales lint. The Eastern Province output was 63,575 tons of seed cotton, giving an average yield of 318 lbs. per acre, whilst Buganda Province produced 49,527 tons with an average yield of 554 lbs. per acre. The Northern Province produced 4,454 tons.

4. The table below shows the approximate figures of acreages planted in the various districts during 1929 and the previous year:—

<i>EASTERN PROVINCE:—</i>				<i>1928.</i>	<i>1929.</i>
Busoga District	...	...	...	114,800	111,324
Budama „	...	...	...	21,590	33,814
Bugwere „	...	...	...	82,170	77,038
Bugishu „	...	...	...	25,070	33,041
Teso „	...	...	...	132,000	107,670
Lango „	...	...	...	71,807	57,015
TOTAL ACRES				<u>447,437</u>	<u>419,902</u>
<i>BUGANDA PROVINCE:—</i>					
Mengo District	...	...	...	102,000	96,093
Entebbe „	...	...	...	47,260	47,299
Masaka „	...	...	...	17,700	28,000
Mubende „	...	...	...	33,140	27,643
TOTAL ACRES				<u>200,100</u>	<u>199,035</u>
<i>NORTHERN PROVINCE:—</i>					
Bunyoro District	...	...	...	9,870	15,600
Gulu „	...	...	...	12,370	17,000
Chua „	...	...	...	11,100	6,800
West Nile „	...	...	...	8,000	—
TOTAL ACRES				<u>41,340</u>	<u>39,400</u>
<i>WESTERN PROVINCE:—</i>					
Toro District	...	...	...	3,000	3,100
Ankole „	...	...	...	7,230	1,720
TOTAL ACRES				<u>10,230</u>	<u>4,820</u>
GRAND TOTAL				<u>699,107</u>	<u>663,157</u>

5. 1929/30 CROP.—Cotton planting was delayed owing to the dry weather during the greater part of June, and the area planted by the end of that month was well below the average, particularly in the Eastern Province. Weather was normal in July and planting proceeded under favourable conditions in all districts, except Lango, where there was a shortage of rain.

6. The autumn rains continued right through to the end of the year with a slight break in November, and as a result of these conditions planting continued later than usual. This compensated to some extent for the shortage of early-sown cotton.

7. The continuation of the rains, whilst favouring late plantings, acted adversely on that part of the crop which was already established, and the appearance of "blackarm" disease on the earlier sowings in the Eastern Province made the prospects less promising.

8. Abnormally heavy rains during December retarded the ripening of the crop and induced considerable vegetative growth. In addition, the dull weather accompanied by low temperatures encouraged the spread of the disease mentioned above, which became very active in the districts of Teso, Lango and Bugwere, and was prevalent also in the eastern parts of Busoga district.

9. In Buganda Province, also, climatic conditions were generally unfavourable and yields were well below the previous season's figures, whilst in the Northern Province, except in the Bunyoro district, a comparatively poor output was obtained.

10. The total crop is expected to reach approximately 120,000 bales, which is roughly 80,000 bales less than the previous season's output.

11. The Buying Combines referred to at para. 25 in the report for 1928 extended their activities to include, in addition to Buganda, parts of the Eastern and Northern Provinces, and in February a Commission of Enquiry was appointed to investigate, *inter alia*, the effects of such combines on the cotton industry.

12. The Report of the Commission was published in June, and as a result of the recommendations made therein the formation of Buying Associations was approved by the Government in principle, and under certain conditions the Government agreed to co-operate.

13. The attitude of the native producers continued to be strongly antagonistic to combines, and owing to the fact that certain districts remained as "free" areas with open competition the higher prices paid therein increased their dislike of Buying Associations.

14. The tax in 1929 on cotton lint exported from the Protectorate was 6 cents ($\frac{3}{4}$ d.) per lb. and realized £230,988 compared with £164,483 the previous year, when the tax was the same. The tax for 1930 was fixed on December 16th at 5 cents per lb., based on the closing price of June "futures" in Liverpool on that date.

15. The extension of the Kenya and Uganda Railway to Soroti from Tororo was opened for traffic during the year. Rapid progress was also made on the Jinja—Kampala extension and the earthworks were completed and the rails laid to within a few miles of the River Nile. It is expected that the Nile Bridge at Jinja will be completed by the end of 1930, and Kampala will then be linked up by rail direct with the Coast.

16. The number of ginneries licensed to gin and bale cotton during the year was 153 compared with 164 in 1928. No fresh sites for ginneries were granted during the year, but there was a tendency for European ginneries to dispose of their interests and several groups of ginneries passed into the hands of Indian firms.

17. Local transactions in baled cotton were again numerous, and particulars of registered contracts representing 165,271 bales were recorded.

18. The following table shews the principal countries to which direct shipments of cotton were made during the year under review and for the two previous years:—

			1927		1928		1929
Great Britain	...	...	35,125	...	49,304	...	44,726
India	...	...	65,846	...	76,304	...	118,529
Japan	...	...	29,697	...	12,728	...	35,139
TOTALS			...	130,668	...	138,336	198,394

19. Exports of cotton seed amounted to 67,525 tons, valued at £423,999, compared with 45,506 tons, valued at £323,110, in 1928.

Coffee.

20. The acreage under coffee at the end of 1929 was estimated to be as shown below, and for the purpose of comparison the figures for 1928 are also given:—

				<i>C. Arabica.</i>		<i>C. Robusta.</i>			
				1929	1928	1929	1928		
				<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>		
Non-native	...	...	...	13,837	12,951	...	5,759	...	5,457
Native	...	...	...	5,417	2,782	...	10,971	...	6,503
				19,254	15,733	...	16,730	...	11,960

21. An increasing interest has been shown in the cultivation of *C. robusta* by non-natives, particularly in the more humid areas of the Buganda Province, whilst the area under *C. arabica* cultivated by non-natives shows a steady increase in the Toro district.

22. The coffee crop in 1929 was above the average, and good yields were obtained in most districts. This position was, however, largely discounted by the fall in prices towards the end of the year when the bulk of the crop was being marketed.

23. The native coffee industry shewed a steady expansion and the free distribution of *C. robusta* plants continued throughout the year in the Buganda Province. The development of this industry proceeded satisfactorily in the Ankole district of the Western Province, where the cultivation of *C. arabica* is becoming increasingly popular with the native cultivators.

24. In the Bugishu district of the Eastern Province, where a flourishing native industry (*C. arabica*) has existed for many years on the foothills of Mt. Elgon, a further increase of acreage was recorded during the year, and it is estimated that 1,379 acres are now under *C. arabica*. The 1928/29 crop amounted to approximately 130 tons.

25. The exports of coffee from the Protectorate during the year amounted to 41,192 cwts., valued at £177,142, compared with 40,355 cwts., valued at £164,187, in 1928.

Rubber.

26. The planted acreage of Para rubber remains practically unchanged, and little interest has been taken in this crop owing to the depressed condition of the market. Tapping has continued on several estates, and exports amounted to 823,100 lbs., valued at £28,818, compared with 1,131,200 lbs., valued at £54,978, in 1928.

Sugar.

27. In addition to the factory established at Lugazi in 1925, work was started on a factory in the Busoga district. The factory at Lugazi was further extended during the year by the addition of more rollers. Both these concerns are due to Indian enterprise.

28. The bulk of the output is absorbed locally, but 4,276 cwts. of sugar, valued at £7,071, were exported to neighbouring territories.

Tobacco.

29. Experimental work in connection with this crop has been continued in the Bunyoro district, and the comparatively small crop produced in that area by native growers was purchased by the British-American Tobacco Co. for use in their factory at Jinja. It is realised that only good types of well prepared leaf can be expected to find a ready export market, and for this reason the development of tobacco growing by natives is being proceeded with cautiously. Non-natives continue to show an interest in this crop. The report of the Officer-in-charge tobacco work will be found on pages 12—15.

30. Exports for the year 1929 amounted to 61,967 lbs., valued at £3,040.

Maize.

31. Large quantities of improved varieties of maize seed were distributed by the Department during the year, and there has been a considerable increase in the acreage planted, particularly in the neighbourhood of the larger towns. Small mills for the production of maize flour have been erected in several centres in the Buganda and Eastern Provinces, and it is hoped that in the near future when milling facilities are improved Uganda will be able to supply its own requirements in this direction.

Tea.

32. The acreage under tea was increased from 297 acres in 1928 to 321 acres in 1929, the cultivation of which is confined mainly to European plantations. Improved machinery has been installed on one of the earlier planted estates, and the prepared product finds a ready sale in Uganda and the neighbouring territories.

Simsim.

33. A considerable increase in the amount of simsim exported was recorded, and the total amounted to 1,338 tons, valued at £24,890, compared with 115 tons, valued at £2,162, in 1928.

Chillies.

34. This crop also shewed an increase over the preceding year, and exports amounted to 6,174 cwts., valued at £26,133, compared with 4,437 cwts, valued at £25,848, in 1928.

Rice.

35. The cultivation of this crop has become more popular during the year in the districts of Bugwere, Bugishu and Budama, the estimated acreages for each district being 8,376, 3,915 and 5,224 acres respectively.

Sisal.

36. The owner of Lugazi Sugar Estate has acquired the lease of a large area of land near Masindi Port for the cultivation of sisal. Work was well forward at the end of the year and extensive nurseries had been established.

Ploughing.

37. A scheme was put into operation in the Eastern Province whereby several blocks of land of about 100 acres each were cleared and stumped, with the object of demonstrating to the natives the advantages to be gained by the use of ploughs and the proper rotation of crops. Fair progress had been made by the end of the year.

38. Ploughing continued to make headway in the Teso district of the Eastern Province, where over 6,000 ploughs are in use. In Bugwere district further progress was made, especially in Pallisa County. Over 2,000 ploughs are now in use in this district, some 639 new ploughs being bought by natives during the year.

39. The following table shews the numbers and principal areas where ploughs are in use in the Eastern Province :—

TESO DISTRICT :—

Soroti County	...	...	...	...	603
Amuria County	...	...	...	...	527
Kumi County	...	...	...	...	3,761
Usuku and Nepak Counties	...	...	...	...	908
Serere County	...	...	...	...	371
					6,170

Of the above 2,468 are stated to have been new purchases in 1929.

BUGWERE DISTRICT :—

Bukedea County	...	...	...	...	1,600	(approx.)
Pallisa County	...	...	...	...	700	(approx.)
					2,300	

Experiment Stations.

40. Reports dealing with the work done at Serere in the Eastern Province and Bukalasa in Buganda Province will be found under their separate headings later in the report.

41. The report on the Ngetta Plantation in Lango district, which is one of the stations financed by the Native Administrations, and alluded to in para. 54 of last year's report, will be found on pages 26—27.

42. Reports by the various officers—Superintendent of Agricultural Education, Entomologist, Mycologist, Botanist and Chemist—working at the Agricultural Laboratories—will be found under their respective headings further in this report.

43. The meteorological observations are now published separately, and the full details of agricultural statistics will be found in the Appendices to this report.

J. D. TOTHILL,
Director of Agriculture.

ANNUAL REPORT OF THE SUPERINTENDENT, AGRICULTURAL EDUCATION.

I returned from leave on February 19th. During the greater part of the year the classes at Makerere College made it impossible for me to leave Kampala for the inspection of other schools during term time. During April certain schools in Masaka district were visited, during June visits were paid to the normal schools at Mbale and Ngora (Teso district), and during September I visited schools in Masaka, Ankole and Kigezi districts.

Staff.

European.—The increased staff sanctioned for agricultural education work began to arrive shortly before the end of the year. Mr. C. W. L. Fishlock, Agricultural Officer, arrived on November 15th. He has been selected to take charge of the schoolmasters' courses on the Bukalasa Plantation, and has been stationed at Bukalasa to gain knowledge of local conditions and of the language.

Mr. R. W. Stuckey, Agricultural Officer, arrived on December 6th, and has been posted to Kampala to undertake the agricultural and botanical teaching at Makerere College and to be in charge of the Kampala Plantation.

Native.—Yoanna Kaidzi has been working as Field Assistant on the Kampala Plantation and has also helped with the Makerere teaching and with other educational work.

Makerere College.

An agricultural class of five pupils completed their third year in December. When these boys started the technical part of their course two years ago it was generally recognised that they did not come up to the standard of the brighter pupils, such as those of the schoolmasters' and medical classes, and it was scarcely surprising that only one of the five was successful in the final examination. Too much reliance cannot, of course, be placed upon examination results alone, but in this case it is safe to say that the standard attained represents very fairly the capacity and general intelligence shown by them throughout the course. It has been arranged to employ these five natives on probation in the department, the successful one at Native Civil Service (Grade B) rates of pay, the other four at lower rates.

This department still undertakes the botanical part of the biological teaching at Makerere College, and a class of eight boys, composed of four veterinary, three medical, and one agricultural student, were given a course in botany during the year, this being the second year of their respective courses.

In addition to this, the one second-year agricultural pupil attended farm classes and lectures in agriculture during the year, and these classes were also attended by the second-year veterinary class, in the absence of facilities for their tuition in veterinary subjects.

All the above teaching, with the exception of outside excursions, was done at the Agricultural Laboratory and on the Kampala Plantation.

Thanks are due to those members of the staff of the department who have given valuable assistance in connection with the Makerere College classes.

Normal Schools.

Visits were paid to the various normal schools as follows:—White Fathers' Mission Normal School, Bikira—April and September; Mill Hill Mission Normal School, Nsambya—April, May and August; C.M.S. Normal School, Mukono—April, August, November and December; C.M.S. Normal School, Nabumale—June; Mill Hill Mission Normal School, Ngora—June; Government Normal School, Kampala—throughout the year.

In all of these institutions a certain amount of nature study and agriculture is taught, and all but the school at Nabumale possessed some kind of a school garden. The teaching of these subjects, however, has yet to improve very considerably before there can be any hope of its being efficiently taught in the elementary vernacular schools, for which these schools train teachers.

Elementary Vernacular Schools.

The following elementary vernacular schools were visited during the year:—White Fathers' Mission—Gayaza, Katende, Kitovu, Busubizi, Mbarara, Lugazi, Rusorozi; C.M.S—Namukozi, Bweraganyi; Mill Hill Mission—Nsambya, Ngogwe; Mohammediya—Kibuli; Government—Kasawo.

Very little in the way of agriculture or nature study was being done in these schools. The increase in staff, to which reference has been made above, however, will enable systematic inspection and assistance to be given to these schools in the future, which should have a considerable effect on their efficiency in these subjects.

As a help in this direction a short course in the teaching of agricultural subjects and school garden work was given during March to the two native inspectors of schools in the Education Department.

Course for Elementary Vernacular Schoolmasters in Agriculture and Nature Study at Bukalasa and Serere Plantations.

Details of these courses and of the objects in view have been given in previous reports. By the end of the year one Agricultural Officer for this work had arrived and had been posted to Bukalasa, and the second Agricultural Officer had been appointed. The class-room and pupils' quarters at Bukalasa were in the course of erection by the end of the year, and it is hoped that they will be finished in time to commence the first course in April, 1930. Each course will occupy three months, and after passing out the pupils should be in a position to teach elementary agriculture and nature study in the schools to which they are posted and to plan and conduct with intelligence a school garden where the principles learnt can be applied.

It is intended to hold at least two courses during the year, and it will be the duty of the officers conducting this work to follow up the pupils who have passed through their hands by visits to their schools, to see that they put their lessons into practice and to help them with suggestions and advice.

Short courses for "Intermediate" schoolmasters will also be available.

Intermediate Schools.

Although agriculture is not such a prominent subject in the curriculum of the intermediate schools as in the elementary vernacular schools, yet many intermediate schools have a school garden and attempt something in the way of simple biological work. Visits were paid to the following Intermediate "A" schools in connection with this work:—

C.M.S. Mengo Central School, Namirembe.

Intermediate "A" School, Mbarara.

Mill Hill Mission, Intermediate "A" School, Nsambya.

White Fathers' Mission, Intermediate "A" School, Kitovu.

Government Intermediate "A" School, Makerere.

Professor Huxley's Visit.

During October Professor Julian Huxley visited Uganda. The whole question of elementary biology and nature study in the schools was discussed with him, especially as regards the normal schools and elementary vernacular schools. Much valuable help and advice was obtained.

General.

I attended the meetings of the Mengo, Entebbe and Mityana District Education Boards during the year.

I also attended the meetings of the Coffee Board.

E. G. STAPLES,
Superintendent of Agricultural Education.

TOBACCO : EXPERIMENTS IN BUNYORO.

I was stationed in Bunyoro during the whole of the year.

Early in February I took over the work from Mr. G. T. Philpott, on his transference to Kampala, and remained in charge up to the end of the year.

Practically the whole of my time has been occupied with the tobacco work.

Mr. T. R. Hayes, of the British-American Tobacco Company, assisted with the supervision of the native tobacco crop whenever it was possible for him to do so, but his duties at the factory held him at Jinja for the most part of the year. He was, however, able to help with the harvesting and curing of the large spring crop, and I was very grateful for his help during that very busy period.

I am further indebted to Mr. Hayes for much valuable and readily given advice with regard to tobacco, and particularly for information and advice with regard to the control of mosaic disease.

I also wish to record my appreciation of the assistance rendered by the local administrative officers, who were always ready and willing to help in every possible way.

(A) Tobacco Experimental Grounds.

1928: 2ND CROP.—The results of this crop could not be included in the annual report of that year, and so are given briefly herewith:—

<i>Variety.</i>						<i>Yield of Cured Leaf per acre.</i>
						<i>Lbs.</i>
Piet Retief Swazie ...	...	...	...	...	...	504
Blue Pryor ...	...	...	...	...	...	154
Melton ...	...	...	...	...	...	224
Western ...	...	...	...	...	...	696
Hickory Pryor ...	...	...	...	...	...	372
B. 1 ...	...	...	...	...	...	330
B. 2 ...	...	...	...	...	...	278

The above figures do not give a true indication of the crop, as the tobacco was grown chiefly for seed selection, the leaves of the selected plants not being harvested.

1929: 1ST CROP.—Owing to the increasing work entailed by the native cultivation, work at the experimental grounds had of necessity to be confined to seed selection and to the trial of new varieties. Nurseries were sown during the first week in February and planting-out took place on the 8th and 9th of April.

The plots consisted of the following varieties:—

SEED SELECTION PLOTS, EACH ONE-EIGHTH ACRE.

Piet Retief Swazie ...	...	...	...	Western.
Blue Pryor ...	...	...	...	Melton.
Hickory Pryor ...	...	...	...	B.1.
Joiner ...	...	...	...	B.2.
D.K.M. ...	...	...	...	D.V.K.P.
D.K.B.P. ...	...	...	...	D.V.L.T.O.

YIELD COMPARISON PLOTS, EACH ONE-QUARTER ACRE.

D.K.M. ...	...	...	...	D.V.K.P.
D.K.B.P. ...	...	...	...	Melton.
D.V.L.T.O. ...	...	...	...	Piet Retief Swazie (Control).

Of the above varieties, D.K.M., D.K.B.P., D.V.K.P., D.V.L.T.O., and Joiner were new, the seed being supplied by the British-American Tobacco Company.

All of the above varieties are of the heavy smoke-curing type excepting Hickory Pryor, which, although really a cigarette tobacco, has been found adaptable to smoke curing.

A week of hot dry weather immediately following the planting caused considerable loss of plants, which were also further reduced by the attacks of crickets and cutworms. Replanting was done later in the month when the weather was more favourable, and eventually fairly good stand was obtained.

The crop made normal progress and was fairly free of disease. Mosaic disease was present to a minor extent, as also was an unidentified rust disease which appeared when the leaf was ripening.

Harvesting commenced on the 15th of July and was practically finished by the end of the month.

Curing was finished by the end of August.

The results are shown below :—

SEED SELECTION PLOTS.

Variety.	Grade 1. lbs.	Grade 2. lbs.	Scrap. lbs.	Total. lbs.	Per acre. lbs.
Piet R.S. ...	31	5	17	53	424
Western ...	82	5	3	90	720
Blue Pryor ...	85	5	6	96	768
Melton ...	105	4	5	114	912
Hickory P. ...	60	6	7	73	584
B. 1 ...	41	5	21	67	536
B. 2 ...	34	9	5	48	384
Joiner ...	72	6	7	85	680
D.K.M. ...	71	5	2	78	624
D.K.B.P. ...	98	8	5	111	888
D.V.K.P. ...	55	12	13	80	640
D.V.L.T.O. ...	63	8	3	74	592

YIELD COMPARISON PLOTS.

D.V.L.T.O. ...	142	4	3	149	596
D.V.K.P. ...	101	6	1	108	432
D.K.B.P. ...	106	9	7	122	488
D.K.M. ...	171	6	5	182	728
Melton ...	139	12	9	160	640
Piet R. S. ...	73	15	15	103	412

The seed selection plots were on land from which one previous crop of tobacco had been taken, and the yield comparison plots on land from which two previous crops of tobacco had been taken.

On the whole, the leaf was of excellent quality.

Varieties of outstanding merit were D.K.B.P., D.K.M., D.V.L.T.O., D.V.K.P., Melton, Blue Pryor and Western. All of these varieties made large, heavy leaves which cured out well.

"Piet Retief Swazie" usually gives a high yield. In this case it was backward in the nursery and consequently late planted. To this cause is attributed the low yield.

"Joiner" has the reputation of being disease resisting. It did not maintain this reputation with us, as it was the most badly diseased of any variety.

All of the leaf resulting from the above crop was handed over to the British-American Tobacco Co. for experimental work in their Jinja factory.

1929: 2ND CROP.—As with the previous crop, the work was devoted chiefly to seed selection. The seed was sown on the 19th July and plants were ready to put out about the middle of September. Owing to dry weather, however, it was not possible to plant until the 4th and 5th of October.

Seed selection plots, each of one-eighth acre, consisted of all the varieties grown for the spring crop, with the exception of Joiner, and of the following new varieties:—"White Burley," "Amotilla," "Warne" and "B. 3." The two latter varieties have proved unsuitable.

"White Burley" is the chief variety used for air curing.

"Amotilla" is a South American variety used for either air or flue curing.

In addition to the above, two half-acres were planted with "Melton" and "D.K.B.P." and a one-quarter acre plot was planted with "Blue Pryor."

The varieties "Melton" and "D.K.B.P." gave the highest yields from the previous crop, and the half-acre plots were planted with a view to obtaining several bales of each in order to export them for brokers' report and valuation, neither of these varieties having yet been exported from Uganda.

The one-quarter plot of "Blue Pryor" was grown for extra seed selection, as there is a big demand for seed of this variety, European planters growing it almost exclusively.

Crickets were exceptionally numerous during the early stages of this crop, and owing to unfavourable weather it was not possible to do much replanting. As a result, some of the plots had many vacant places.

Locally the weather continued dry throughout November, although half-a-mile on either side of the experimental grounds the rainfall was ample. In spite of the adverse conditions, however, most of the varieties made good progress, and with a few exceptions were particularly healthy. The exceptions were "Piet Retief Swazie," which was heavily infected with mosaic disease, the infection amounting to as much as 90%, and "Warne" and "B.2," which were infected with the same disease to practically 100%. Other varieties were affected to a minor extent.

Harvesting took place during December and the tobacco is, at the time of writing, in the curing barns. The leaf is well up to average.

The varieties "White Burley" and "Amotilla" are being air cured in order to see if this type of tobacco may be of use in the local factory.

(B) Native Cultivation.

The progress made by this comparatively new native crop is evident by a glance at the following figures:—

Year.			Crop. lbs.		Value. Shs. cts.
1927—1st Crop	...	...	1,631	...	427 00
2nd "	...	...	Failure owing to drought.		
1928—1st "	...	...	5,377	...	1,539 60
2nd "	...	...	55,979	...	15,329 60
1929—1st "	...	...	89,316	...	23,581 20

The values given represent the actual amounts paid to the growers.

Owing to the small supervisory staff available, the 1929 2nd crop was limited and is expected to amount to about 40,000 lbs.

For the 1930 1st crop, an increased acreage is projected.

The whole of the native crop has up to the present been purchased by the British-American Tobacco Co.

1928: 2ND CROP.—This crop was purchased in January and February, 1929. On the whole the tobacco was very good, though a proportion of it was badly cured owing to the inexperience or negligence of the growers.

Much of the leaf was marketed in poor condition, *i.e.*, too wet or too dry. This led to considerable waste, as on opening up the bales at the factory, it was found that some of the leaf had rotted owing to excessive moisture, whilst that which was marketed in too dry a condition was badly broken.

1929: 1ST CROP.—The varieties grown were "Western," "Piet Retief Swazie" and "B. 1," and the acreage was estimated at 180 acres. Approximately 20 acres were totally destroyed by a severe hailstorm which occurred on the 24th of June, just before harvesting commenced.

The crop turned out particularly good, both as regards quantity and quality.

Greater attention was given to the grading and tying, and the crop was marketed in excellent condition as regards moisture.

1929: 2ND CROP.—For this crop the varieties were "Western," "Piet Retief Swazie" and "Blue Pryor." As mentioned above, the cultivation was limited, the acreage being approximately 100 acres.

The yield was expected to be in the neighbourhood of 60,000 lbs., but owing to the almost complete failure of the "Piet Retief Swazie" due to mosaic disease, the estimate has been reduced by a third. Although growing under exactly the same conditions, the other two varieties suffered from mosaic to a slight degree only.

Excepting the "Piet Retief Swazie," the crop is well up to average, some of the "Blue Pryor" being exceptionally fine. This crop is at the time of writing in the curing barns.

DISEASES AND INSECT PESTS.

Mosaic.—This is by far the most serious tobacco disease at present occurring in Uganda.

It may be seen in any field of tobacco, but usually only to the minor extent that one comes to regard almost as normal. As reported above, however, it will be seen that on occasion mosaic can become extremely serious.

In America it has been proved that the disease is chiefly transmitted at planting time through the agency of the planters who chew natural leaf tobacco. All unmanufactured tobacco carries the disease, and experimentally mosaic has been eliminated by providing the growers with manufactured tobacco for use when planting.

Our native growers do not as a rule chew tobacco, but most of them smoke, and as they almost invariably use native natural leaf tobacco it will be seen that we have here all the conditions necessary for the rapid spread of the disease.

It is not so apparent why one particular variety should suddenly become so heavily infected, since the source of infection remains constant.

Any control methods should aim at protecting from infection the young plants whilst they are in the nursery and until they are established in the field, as it should be noted that a late infection, *i.e.*, after the plants have been in the field two weeks or more, does not affect the subsequent crop to any great extent.

Acting on a suggestion put forward by Mr. Hayes, an attempt is being made to control the disease by disinfecting the "contacts." All men working in the nurseries will be taught to wash their hands in a solution of "Jeyes" before handling the plants, and at any time after touching native tobacco—to fill their pipes, etc.—also, all growers will be made to wash their hands in the disinfecting solution when they come for plants, and they will be instructed not to touch native tobacco until they have finished planting.

The success of this method depends entirely on the degree of loyalty with which the instructions are observed.

"*Frenching*."—This disease is often confused with mosaic, probably because both diseases frequently infect the same plant. Infected plants are very stunted and the leaves are malformed. Although not nearly so serious as mosaic disease, the aggregate loss in yield from this disease is considerable.

It seems probable that we do not get true "Frenching" disease in Uganda, or at least to a small extent only, as here the trouble appears to be physiological rather than pathological.

From observations carried out on a large number of plants, I am convinced that the so-called "Frenching" here is due to the tap root being bent by improper planting. An experiment designed to test this theory shewed that 90% of the plants planted with bent tap roots developed typical symptoms of "Frenching."

Rust Disease.—An unidentified rust disease sometimes appears when the tobacco is ripening. As it spreads very rapidly it is necessary to harvest the crop as quickly as possible as soon as the disease is noticed.

White Rust or Mildew.—Isolated outbreaks of this disease, caused by *Oidium* spp., have occurred. It is brought about by overcrowding and humid conditions, and rarely occurs where the correct spacing has been given.

The spacing advocated for our type of tobacco is $3\frac{1}{2}$ ft. by $3\frac{1}{2}$ ft.

Insect Pests.—Cutworms and the large mole crickets were very troublesome while the plants were young. The growers were taught to make a daily search for these, as well as for other kinds of crickets which feed on the young leaves.

Caterpillars of the *Heliothis obsoleta* moth did considerable damage to the seed heads.

The stem borer, *Pthorimæa heliopa*, was almost entirely absent.

G. HAZEL,

Plantation Manager.

ANNUAL REPORT ON SERERE EXPERIMENTAL STATION, 1929—1930.

The present report could not be completed by Mr. G. F. Clay owing to his early departure on leave. The writer, having been at Serere until June, 1929, and taking charge on his return from leave in January, 1930, is able to include the whole of the results of the year's work, the "agricultural year" being roughly from April 1st to March 31st.

Experimental Farm.

This consists of—

- (1) Three blocks of 10 acres for variety trials and cultural experiments.
- (2) Three blocks of 1 acre each for progeny rows.
- (3) Three blocks of 2 acres for increase of new strains.
- (4) Permanent rotation experiment of $1\frac{1}{2}$ acres.

The main blocks, progeny row blocks and increase blocks are all to be put under a rotation including a green manure. In each of the ten-acre blocks there is reserved three acres to be used only for variety trials, so that no effects from different cultural treatments shall remain to affect the results of the variety trials.

The whole of the Experimental Farm is newly opened land, and only one of the ten-acre blocks was cropped in 1929. This was put down to cotton and a uniformity trial was conducted on it by the Cotton Botanist. One progeny row block and one increase block were also used for cotton and the permanent rotation experiment was started. All the rest of the new land will be cropped in 1930—1931.

Seed Farm.

The new land referred to above being in process of clearing and cultivation, and therefore not being ready, the seed farm was used for the experimental work on crops other than cotton.

BULO (ELEUSINE) VARIETY TRIAL.—Four varieties of bulo from single plant selections made by the writer at Ngetta in 1927, and grown in a chessboard variety trial there in 1928, were sown in strips five times replicated, alternately with strips of a control. The control used was the Teso "Engenyi" bulo. The strips harvested were of $\frac{1}{40}$ th-acre.

The following table summarises the results:—

Variety of Bulo.		Mean Yield of Strips—Lbs.				Difference.	Standard Error.
		Control.					
No. 2	...	38.4	...	33.5	...	+ 4.9	3.74
„ 4	...	42.8	...	27.5	...	+ 15.3	6.23
„ 6	...	32.6	...	34.3	...	— 1.7	3.78
„ 9	...	49.2	..	38.8	...	+ 10.4	5.68

The results showed a statistically significant increase in the yield of No. 4 over its control and that No. 9 was significantly better than variety No. 6.

These varieties of bulo have been sent back to Ngetta, as work at Serere is being confined to economic crops.

SIM-SIM SOWING DATE TRIAL.—Four sowing dates at fortnightly intervals, April 5th—May 17th, with ten repetitions of $\frac{1}{15}$ -acre were sown at the rate of $4\frac{1}{2}$ lbs. of seed per acre. The plots were arranged in random blocks and sown with the seed barrow.

		Sowing Date.								
		April 5th.		April 19th.		May 3rd.		May 17th.		Standard Error.
Mean yield in lbs.	...	25.0	...	16.8	...	8.9	...	3.6	...	3.64
Yield as % of mean	...	183.8	...	124.3	...	65.4	...	26.4	...	26.70

These results showed that in this experiment 5th April sowing was better than any, 19th April sowing was better than May 3rd and May 17th. There was no significance between May 3rd and May 17th.

SIM-SIM VARIETY TRIAL AND SIM-SIM SEED RATE TRIAL.—The variety trial included four varieties:—

- Emong (light-coloured capsules).
- Etegu (light-coloured capsules).
- Emong (dark-coloured capsules).
- Etegu (dark-coloured capsules).

The seed rate trial was to test four seed rates, $2\frac{1}{2}$ lbs., 5 lbs., $7\frac{1}{2}$ lbs., and 10 lbs. per acre.

In both experiments the randomised block system of arranging the plots was adopted.

Unfortunately the sim-sim was a failure owing to drought, aphid and mildew and the variety trial was abandoned. The seed rate trial was harvested, but the random errors were greater than the variance due to treatments and no significance attaches to the results.

MAIZE SPACING TRIAL.—The following spacings for maize were tried:—2 ft. by 1 ft. 9 ins.; 3 ft. by 1 ft.; 3 ft. by 2 ft.; 4 ft. by $1\frac{1}{2}$ ft. Nine blocks of four plots arranged at random were planted, the size of the plots being $1/28$ th of an acre.

YIELDS OF HULLED MAIZE.

<i>Spacing.</i>				<i>Mean yield in lbs.</i>
2 ft. by 1 ft. 9 ins. ...	...	...	...	79.3
3 ft. by 1 ft. ...	...	...	...	78.7
3 ft. by 2 ft. ...	...	...	...	78.2
4 ft. by 1 ft. 6 ins. ...	...	...	...	72.7

This experiment shows no significant difference of yield between the different spacings, but it is not conclusive as the random variance was greater than that due to treatments.

MAIZE VARIETY TRIAL.—The following table summarises the results of a variety trial of four varieties of maize. The randomised block system was adopted, there being twelve repetitions of the four varieties grown in $1/28$ -acre plots.

YIELDS OF HULLED MAIZE PER PLOT.

		Variety.								
		Hickory King.	Potchefstroom Pearl.	Salisbury White.	" 40 Day."		Standard Error.			
Mean yield in lbs.	...	66.0	...	67.7	...	71.9	...	33.7	...	3.94
Expressed as % of mean	...	108.0	...	110.8	...	117.6	...	63.3	...	6.44

These results show that Hickory King, Potchefstroom Pearl and Salisbury White are all significantly better yielders than 40-day maize, and equal among themselves.

GROUNDNUT SPACING AND CULTURAL TRIAL.—In this experiment there were four different spacings combined with three cultural treatments, rows, mounds, and broadcast. For the latter plots, which were, of course, on the flat, the seed rate was calculated at the same rate as its corresponding spacing in rows, and 25% was added to allow for non-germination. One resowing was allowed in all but broadcast plots. There were five randomised blocks of twelve plots; thus there were 60 plots of $1/28$ -acre each.

YIELDS OF GROUNDNUT PLOTS.

		<i>MEAN YIELDS IN LBS.</i>					
		<i>Spacing.</i>					
		<i>1 ft. 6 ins. by 1 ft. 6 ins.</i>	<i>3 ft. by 1 ft.</i>	<i>3 ft. by 2 ft.</i>	<i>2 ft. by 1 ft.</i>		
Rows ...	26.8	...	16.4	...	12.1	...	24.1
Mounds ...	21.1	...	16.3	...	11.6	...	27.1
Broadcast ...	22.5	...	17.7	...	14.9	...	23.2

The standard error of the comparisons was 4.33, and the results show the following conclusions:—

Spacing 2 ft. by 1 ft. on mounds was significantly better than all 3 ft. by 1 ft. and 3 ft. by 2 ft. plots.

Spacing 1 ft. 6 ins. by 1 ft. 6 ins. in rows was significantly better than all 3 ft. by 1 ft. and 3 ft. by 2 ft. plots.

Spacing 2 ft. by 1 ft. in rows was significantly better than 3 ft. by 2 ft. plots.

Spacing 2 ft. by 1 ft. broadcast was significantly better than 3 ft. by 2 ft. in rows and mounds.

Spacing 1 ft. 6 ins. by 1 ft. 6 ins. in mounds and broadcast was significantly better than 3 ft. by 2 ft. in rows and mounds.

There was no difference sufficient for statistical significance between 2 ft. by 1 ft. and 1 ft. 6 ins. by 1 ft. 6 ins. spacings, nor between 3 ft. by 1 ft. and 3 ft. by 2 ft. spacings either when sown in rows, mounds or broadcast.

Generally the experiment showed superiority of the two smaller spacings over the two larger spacings, and no difference between rows (sowing in lines), mounds (sowing in ridges), and broadcasting at the same seed rate.

Main Crops.

The main crops yielded as under :—

Bulo	...	...	...	938 lbs. grain per acre.
Maize "40 Day"	...	...	...	880 lbs. " " "
Groundnuts (bunch)	...	...	...	702 lbs. unshelled per acre.
Groundnuts (spreading)	...	...	...	822 lbs. " " "
Maize (autumn sown)	...	...	...	545 lbs. grain per acre.

There was no main crop of sim-sim or spring maize as the land was occupied by experimental plots of these crops. The yield from the maize plots corresponded to a yield per acre of 1,960 lbs. grain per acre.

Cotton.

1928—1929 CROP.—This was the new strain S.G. 29, thirty-four acres of which yielded at the rate of 459 lbs. per acre. The seed ginned from it was sent to the Mulondo peninsula.

1929—1930 CROP.—The new strain S.G. 27 was planted on the seed farm on three blocks of a total acreage of 27 acres. One of these blocks was planted in June, but the other two being occupied by experimental work on other economic crops during the first part of the year, could not be sown until August. All this cotton was attacked by blackarm, so that much of the crop was lost through premature opening of the bolls, and the very poor development of those which would have provided the later pickings.

The yields were—

				<i>Lbs. per acre.</i>
Block 3 (August sown)	...	...	...	124.5
Block 5 (August sown)	...	...	...	131.5
Block 8 (June sown)	...	...	...	383.0

The total crop of cotton from the seed farm was 6,008 lbs. seed cotton.

Mass Selection.

The seed farm has a twofold purpose:—(1) To increase the bulk of new strains of cotton so that enough seed is produced to plant up Mulondo; (2) to provide improved seed of crops other than cotton for distribution to natives through an organised system of seed increase plots in the district.

To this end mass selection is carried out on maize, groundnuts and sim-sim, attention being paid chiefly to yield and type. The resulting mass selection of seed when in sufficient bulk is grown on the seed farm for distribution.

A good type of Hickory King maize has been provided in this manner and is now being grown in muruka seed distribution plots in all districts of the Eastern Province.

Conclusion.

It will be seen that a considerable amount of information was obtained from experimental work on all the important crops (cotton is reported on elsewhere by the Cotton Botanist) and that some of the trials were inconclusive. Also, that the work of increasing cotton and other crops was hampered by having to conduct experiments on the same land. This state of affairs should not occur again. The new farm is expected to give more reliable experimental results, while the seed farm, being used exclusively for increasing the bulk of cotton strains and mass selected maize, groundnuts, and sim-sim will have its usefulness very much increased.

C. E. J. BIGGS,

Acting Senior Agricultural Officer.

ANNUAL REPORT ON BUKALASA EXPERIMENT STATION.

Meteorological.

The spring rains were unusually light, the autumn rains being heavy and continued throughout December, over six inches being recorded during that month.

Labour.

The average number of men employed per month was 105. Labour was plentiful throughout the year. Approximately 70% of the labour employed is resident either on, or near, the plantation and is regular in attendance each month, the remainder is casual labour employed during the more busy seasons.

Crops.

COTTON EXPERIMENTS, 1928-29 RESULTS.—The cotton experiments undertaken during the season 1928-29 were a repetition of those laid down in 1927-28; a summary of the lay-out and object of these trials will be found in the annual report on the plantation for 1928. For the purpose of comparison the figures for the 1927-28 season are included in the results noted below.

SOWING DATE AND SPACING EXPERIMENT.—The results are shown in Table I. With regard to the 1928-29 season it will be seen that there is no significant difference between the mean yields from each of the spacings at all sowing dates, but at all spacings July sown cotton gives a significant increase over cotton planted in August.

COTTON VARIETY TRIAL.—The varieties chosen for trial were: Local, S.G. 29, S.G. 26, and S.G. 15. These were sown in plots 1/25-acre, each variety repeated five times.

Yields.—

Variety.		Total yield 5 sub-plots lbs.		Mean lbs.		Estimated yield per acre lbs.		Brokers' valuation based on middling American—9·90d.
Local	...	85·70	...	17·14	...	428·5	...	10·95d.
S.G. 15	...	65·35	...	13·07	...	326·7	...	11·35d.
S.G. 26	...	74·75	...	14·95	...	373·7	...	11·05d.
S.G. 29	...	91·60	...	18·32	...	458·0	...	11·15d.

S.E.M.D. 0·88.

It will be seen that the varieties S.G. 29 and Local gave a significant higher yield over S.G. 26 and S.G. 15.

COTTON AND BEANS EXPERIMENT.

	1927—1928.			1928—1929		
	Total 10 sub-plots lbs.	Mean lbs.	Yield per acre lbs.	Total 10 sub-plots lbs.	Mean lbs.	Yield per acre lbs.
Cotton interplanted with beans	... 183	... 19·30	.. 732	... 179·0	... 17·9	... 716
Cotton following beans	... 197½	... 19·75	... 790	... 184·5	... 18·5	... 740

S.E.M.D. 2·3.

S.E.M.D. 1·21.

AGRICULTURAL CHEMIST'S LIME AND GREEN MANURE EXPERIMENT.

	1927—1928.		1928—1929.	
	Total 6 sub-plots lbs.	Mean lbs.	Total 6 sub-plots lbs.	Mean lbs.
Lime and green manure	... 148½	... 24·7	... 123½	... 20·6
Lime	... 155½	... 26·0	... 140	... 23·3
Control: No treatment	... 162½	... 27·0	... 158½	... 26·5

S.E.M.D. 1·55.

S.E.M.D. 2·37.

AGRICULTURAL CHEMIST'S CROP RESIDUE EXPERIMENT.

	Season 1927—1928.		Season 1928—1929.	
	Total 5 sub-plots lbs.	Mean lbs.	Total 5 sub-plots lbs.	Mean lbs.
Cotton after beans	... 144	... 29	... 72·75	... 14·60
Cotton after maize	... 134	... 27	... 76·18	... 15·20
Cotton after groundnuts	... 120	... 24	... 72·63	... 14·50
Cotton after simsim	... 132	... 26·4	... 76·49	... 15·30
Cotton after potatoes	... —	...	... 82·92	... 16·16

S.E.M.D. 2·99

S.E.M.D. 1·64

CONTINUOUS COTTON.—The quarter-acre plot of continuous cotton has yielded as under :—

Season 1927-28	...	...	...	at 464 lbs. per acre.
„ 1928-29	...	...	...	at 356 „ „ „

RATOON COTTON.—A quarter-acre plot of cotton, variety S.G. 29, was ratooned in the spring, after picking of the 1928-29 crop had been completed. The trees on half the plot were cut back on the 27th March, the remainder on the 12th April. The plants were cut down to within one foot of the ground, only this amount of the main stem being left. Subsequent growth during April and May was excellent. Flowering commenced during the first days of May and continued until the end of August, with a maximum flowering period from the 10th July to the 19th August.

On three plants chosen for observation the total number of flowers produced were: 119, 178 and 203 respectively. From June onwards a gradual deterioration set in, blackarm attack became apparent, the leaves became reddened and small and the plants presented a most unhealthy appearance. Insect attack was slight. From the 21st May until the 17th September only ten stainers were found on the three plants under observation (observations being taken at weekly intervals). But few Jassids could be found.

What crop there was ripened during the wet weather of September and October—the bolls were undersized and the lint of poor quality. The following comparison between the lint and that of the previous annual crop was made by the Cotton Botanist :—

	S.G. 29 Ratoon.				S.G. 29 Annual.				
<i>Appearance</i>	...	Clean, only a little stain.	Im-	...	White colour. A little stain and	...	...	...	
		mature lint very noticeable.			some immature lint.				
<i>Lustre</i> ...	...	Bright	...	...	Bright.	...	...	...	
<i>Strength</i> ...	...	Weak	...	...	Above average, but rather	...	...	...	
					irregular.				
<i>Lint length</i>	...	28.62 m.m. $\pm$ 0.28; S.D. 2.01	...	...	29.40 m.m. $\pm$ 0.31; S.D. 2.16.	...	...	...	
<i>Seed weight</i>	...	9.27 gms. per 100 seeds	...	...	9.83 gms. per 100 seeds.	...	...	...	
<i>Lint index</i>	...	4.66	...	...	5.63.	...	...	...	
<i>G. O. T.</i>	...	33.4 %	...	...	36.3 %.	...	...	...	
<i>Remarks</i>	...	Rather neppy. Fairly regular for lint length. Weakness due to the large proportion of immature lint. The lint index is rather low.				Rather neppy. Fairly regular for lint length. Remarkable difference in the lint index of this sample as compared with S.G. 29 ratoon.			

Food Crops.

MAIZE.

SPACING TRIAL.—A spacing trial with “Potchefstroom Pearl” was carried out during the spring rains. The following spacings were tested: 4 ft. by 2 ft., 4 ft. by 1 ft., 3 ft. by 2 ft., 3 ft. by 1 ft., with one and two plants per hole at each spacing. Plots 72 ft. by 42 ft., repeated five times in a random scatter.

Yields obtained were as under :—

<i>Spacing.</i>	<i>Total, 5 plots.</i>		<i>Mean.</i>	} S.E.M.D. 19.7
	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	
4 ft. by 2 ft.—1 plant per hole	...	888	...	
4 ft. by 2 ft.—2 plants per hole	...	1,037	...	
4 ft. by 1 ft.—1 plant per hole	...	1,257	...	
4 ft. by 1 ft.—2 plants per hole	...	1,334	...	
3 ft. by 2 ft.—1 plant per hole	...	1,093	...	
3 ft. by 2 ft.—2 plants per hole	...	1,392	...	
3 ft. by 1 ft.—1 plant per hole	...	1,290	...	
3 ft. by 1 ft.—2 plants per hole	...	1,375	...	

A total yield of 7,528 lbs. seed was obtained=2,700 lbs. per acre.

VARIETIES.—Several varieties, new to this country, were introduced by the Botanist at the beginning of the year. Owing to the limited amount of land available it was not possible to lay out a proper variety trial, and all that was attempted was to grow these varieties to determine if any were in any way superior to the already established varieties “Potchefstroom Pearl” and “Salisbury White.” The seven varieties were grown in adjacent plots (0.35 acre each) and the standard variety “Salisbury White” was included for comparison. In addition, isolation plots were grown of the varieties “White Pearl,” “Imperial White Dent” and “Muratha” and a few plants of all varieties were selfed for seed purposes.

Some notes on these varieties are given below (Table 2) :—

TABLE II.

MAIZE VARIETIES.

Variety.	Planted.	Tillering.	Order of flowering.	Leaf disease <i>Helminthosporium</i> sp.	Harvested.	Yield lbs. in cob.	Shelling percentage.	= lbs. seed per acre.	Remarks.
Muratha ...	... 4th April, 3 ft. by 2 ft.	Nil	6	Nil	16th August	1,405	% 82	3,280	A good average maize. Medium grain. White Dent.
Imperial White Dent ...	... "	Nil	3	Very bad ...	28th July— 6th August	494	85	1,190	Poor. Medium grain. White Dent.
Chester County	... "	Medium...	4	Rather bad but developed late.	"	1,086	85	2,635	Would have been good except for disease. Small seeded. Yellow Dent.
Natal 8 Row	... "	Many	2	Bad	"	724	81	1,620	Poor. Fairly large seeded. Yellow Flint.
White Congo	... "	Many	1 (early)...	Bad	"	1,036	81	2,349	Poor. Large opaque seeds. White Flint.
Flat White	... "	Nil	8 (late)	Nil	17th August	1,300	80	2,960	Excellent. Large seeds. White Dent. Very similar to Potchefstroom Pearl.
White Pearl	... "	"	5	Bad	25th July— 6th August	1,389	84	3,276	Poor. Small seeds. White Dent.
Salisbury White	... "	"	7	Very slight	16th August	1,636	84	3,864	Good average. Medium grain White Dent.

SIM-SIM—(*Sesamum indicum*).

Native food crops, such as beans, groundnuts and sim-sim, are invariably sown broadcast, and often mixed with other crops. It is thought that the spacing thus obtained is not conducive to maximum yields. In 1928 a trial was laid down in which sim-sim was sown in lines (lines one foot apart and plants singled to one foot in the rows) against sim-sim grown broadcast. This resulted in the line plots giving a yield of 347 lbs. per acre against 213 lbs. per acre for the broadcast plots (mean yield per sub-plot broadcast 27 lbs., line 43 lbs., S.E.M.D. 2·7).

This trial was repeated this year, 12 plots (one-quarter acre each), six of each method of sowing. The results were as under:—

LINE PLOTS.—

Plot ...	A1.	A3.	A5.	A8.	A10.	A12.	Total.
Lbs. cleaned seed ...	69	109	88	90	86	87	529

= 353 lbs. per acre.

BROADCAST PLOTS.—

Plot ...	B2.	B4.	B6.	B7.	B9.	B11.	Total.
Lbs. cleaned seed ...	33	48	52	60	52	57	302

= 201 lbs. per acre.

Mean yield per sub-plot.—

Broadcast ...	...	...	50·3 lbs.
Line ...	...	...	88·2 lbs.

} S.E.M.D. 5·1.

VARIETIES.—The following varieties were grown for selection and increase purposes:—

- (a) Variety, Serere.
- (b) " Native.
- (c) " Bukalasa selected.

MUHOGO—(*Manihot utilissima*).

VARIETY TRIAL.—The variety trial laid down during the autumn rains of 1928 was harvested during the year.

Yields.—

	Variety.				
	Bitamisi.	Mukedi.	Nakitenbe.	Nyumbezunga.	Nakachachali.
Total, 5 sub-plots : lbs.	2,275	1,133	777	954	925
= Tons per acre	14·2	7·0	5·3	6·0	5·8

Other varieties yielded as under:—

Variety.	Roots.	lbs.	lbs. per root.
Bitijuma ...	100	1,377	13·7
Bobby Hanson ...	100	1,663	16·6
Greyhound ...	100	1,496	14·9
Brownstick ...	100	1,108	11·1

The varieties have been transferred to Block B, Plot 2.

PLANTAINS AND BANANAS.

The results of the method of planting experiment with "bitoke" are given below. Unfortunately the banana weevil borer (*Cosmopolites sordida*) was found in the plot and attempts to eradicate this pest, by digging out infested stools and general cleaning up, have somewhat checked the progress of the experiment. The effects of this insect can be seen in the low average weight per bunch in both systems of planting:—

JULY, 1928—END OF NOVEMBER, 1929.

Plot.	Number of bunches harvested.				Total lbs.	Average weight per bunch.
	Ripe.	Fallen.				
Jamaica—1	18	20	...	791	...	20·8
2	40	27	...	1,514	...	22·6
5	32	17	...	1,219	...	24·9
8	56	44	...	2,565	...	25·6
9	40	33	...	2,162	...	29·6
						— av. 24·7
Baganda—3	26	26	...	935	...	18·0
4	18	32	...	961	...	19·2
6	28	44	...	1,273	...	17·6
7	38	41	...	1,398	...	17·7
10	42	61	...	2,155	...	20·9
						— av. 18·7

Jamaica method.—Average weight per bunch : 24·7 lbs. Total : 8,251 lbs.=5 tons per acre.

Baganda method.—Average weight per bunch : 18·7 lbs. Total : 6,722 lbs.=4 tons per acre.

SWEET POTATOES.

The following varieties are under observation—Buwala, Kiwoko, Nakamogoli, Ngalazachwa, Magabali, Kifefe, Mulalama, Tulankusimye, Kawo, Wakiriga, Namusenda, Njiwayiwa. Other varieties are being collected as opportunity offers.

BULO—(*Eleusine coracana*).

Five varieties were grown in the spring rains for increase and selection.

Yields:—

Variety.		
No. 19	...	at 1,150 lbs. seed per acre.
Local	...	at 1,850 " " " "
No. 11B	...	at 575 " " " "
No. 20B	...	at 1,038 " " " "
No. 14	...	at 1,150 " " " "

In the autumn, selections made in these varieties were grown, and, in addition, the varieties Katete, Kilwamwiko, Kabumburiga, Wambali, Katatangate, Rukindo and Kitageswa. At the time of writing these are still in the ground.

GROUNDNUTS.

Two new varieties were introduced during the year. A plot of Bukalasa selected groundnuts yielded at the rate of 1,226 lbs. unshelled nuts per acre. Further selections in this variety were made.

Miscellaneous Crops.

Other crops grown included: Rice (three varieties), chillies (three varieties), muwemba (*Sorghum* vars.) (three varieties), and tobacco.

Fruit Trees.

A plot below the 4th class house was cleared and planted with budded fruit trees—oranges, limes and tangerines—received from the Botanist. These were planted in June and are now well established. The old fruit tree plot was cleared of "lumbagu" (*Digitaria abyssinica*) and put down, in the autumn, to a cover crop.

Model Shamba.

The three-acre model holding has been continued, though early in the year it was decided to somewhat modify the rotation. The holding has now completed two years, the first showing a cash net profit of Shs. 108/16, the second of Shs. 149/20. It must be realised, however, that this actual cash profit is not the only advantage to be obtained by the holder of such a farm. In the first place it is hoped in time to prove that shifting cultivation as practised at present by natives is as unnecessary as it is undesirable; it is hoped to show that, by adopting a suitable rotation and some simple system of manuring (more particularly green manuring), a man can take up a small piece of land, develop it, and become in time a real peasant farmer. Further, the cash profit mentioned above is in addition to the food which he grows sufficient for him and his family. As the result of a suggestion by the Senior Agricultural Officer, Serere, the rotation adopted for the first two years was changed and is now as under. Apart from the "lusuku," the land is divided up into two portions, each of which is subdivided into four plots. On the first portion (A) the holder grows his cotton and all saleable food crops, on the second (B) his food crops for home consumption.

ROTATION ON A:—

- 1st year.—Groundnuts.
Maize.
- 2nd year.—Green manure.
Cotton.
- 3rd year.—Maize.
Cotton.
- 4th year.—Sim-sim.
Cotton.

ROTATION ON B:—

- 1st year.—Bulo.
Beans.
- 2nd year.—Potatoes.
- 3rd year.—Mpindi.
Green manure.
- 4th year.—Mowogo.

At the time of writing the holding looks very well, no signs of soil deterioration are apparent, and it certainly carries the best crop of cotton on the plantation.

Cover Crops and Green Manures.

The following cover crops and crops suitable for green manuring were grown to determine their suitability. Several of these were newly introduced by the Botanist. *Crotalaria striata*, *Crotalaria incana*, *Crotalaria intermedia*, *Crotalaria* sp. from Java, *Crotalaria anagyroides*, *Cassia* spp., *Centrosema pubescens*, *Centrosema plumerii*, *Indigofera anil*, *Calopogonum*

mucunoides, *Tephrosia* sp., and several varieties of beans and cowpeas. These were all grown in the open and no indication has been obtained as to their capabilities of growing under shade. The most promising at present are:—

(a) *Centrosema plumerii*.—Perennial. Low, spreading, covering the ground completely. Smothers all weeds, and provides a heavy mass of green material.

(b) *Calopogonium mucunoides*.—Perennial. Similar in habit to *C. plumerii* above, but does not produce as much green material.

(c) *Crotalaria* sp. from Java.—Annual. A low growing crotalaria providing a fairly good cover.

(d) *Dolichos lab-lab*.—Provides a very luxuriant cover and lasts well over dry periods. Seed sown in April—May quickly produced a heavy cover and was still as green at the end of the year.

(e) *Crotalaria striata*.—Annual. A quick grower and germinates well even if weather conditions are rather unsuitable. Becomes woody. Unfortunately (a) (b) and (d) above have a climbing habit.

Coffee.

In the spring six acres were put down to robusta coffee. An experiment was designed to determine the effect of permanent, temporary and no overhead shade, in each case in conjunction with cover crops and clean weeding. The six acres were divided up into 36 sub-plots, each 70 ft. by 100 ft. The coffee was planted 10 ft. by 10 ft. square, bananas being used for temporary shade and *Gliricidia maculata* for permanent shade—the shade trees being planted 20 ft. by 20 ft. diagonal. Mpindi was sown in the cover crop subplots in the autumn. The coffee, despite the comparatively light spring rains, has made good growth and is now well established. 300 trees, the progeny of the Botanist's robusta selections, were planted out. 42,500 robusta seedlings were issued from the beds to gombolola nurseries in Bulemezi saza.

General.

The hill between the top of Block A and the second-class house (13 acres) was cleared during September and October, and most of the "lumbugu" removed, the top and a central strip—in all about six acres—were planted with *Paspalum* grass, the two sides being put down to a cover crop (*Crotalaria striata*) pending the demarcation of the compounds of the two new houses to be built. Next spring rains it should be possible to complete the planting of the hill with short grass. The main west road was re-made, ditches dug, and the road gravelled during November. The Public Works Department commenced work on the new buildings for the normal school training courses (lecture room and pupils' quarters) on October 2nd. Two more native food stores were built in December.

Distribution of Seeds and Plants.

The following amounts of seed were issued to various districts during the year:—

Maize:—Var. Potchefstroom Pearl	...	...	...	7,435 lbs. seed.
				3,300 lbs. in cob.
Beans:—Var. Navy	...	...	...	600 lbs.
Maguluganamanye	...	...	...	150 "
Mutike	...	...	...	300 "
Bulo. Var. Local	...	...	...	230 "
<i>Crotalaria striata</i>	...	...	...	38 "
Bitoke suckers, Var. various	...	...	...	12 "
Fruit trees, various	...	...	...	46.

Most of this seed is issued direct to individual growers, and soon becomes lost or mixed with the ordinary native varieties. Under this system of distribution it is not possible either to ensure that the seed is kept pure or to keep an adequate check on the planting with a view to further distribution in the second season. The need for the institution of some organized system of seed distribution—such as Lukiko plots—is badly felt.

A. B. KILLICK,

Agricultural Officer.

ANNUAL REPORT ON NGETTA FARM.

The Ngetta Farm is situated on the Kitgum road about four miles from Lira station. It is financed by the Native Administration for the purposes of agricultural demonstration and seed production. Some cultural experiments are conducted whenever possible to test possible new methods of crop management. Costings of all crops are also kept to determine the output capacity of the ordinary labourer in order to discover a suitable rotation of crops for the Lango peasant.

The farm covers an area of 36 acres, of which two acres are under buildings. A nursery is also attached for the production of any special tree or plant.

The weather during 1929 was barely favourable for crops. The rains were a month late in starting and this caused a corresponding delay in all operations throughout the year. A low rainfall in June and July also delayed the planting of cotton and forced the ripening of food crops owing to the low moisture content of the soil. Yields from the first food crops were light. The autumn crops were saved by a remarkably heavy rainfall in December.

The 1929 rainfall of 44.80 inches was 11.52 inches below normal, and 23.51 inches below 1928.

On the other hand the December rainfall of 4.71 inches was 3.83 inches above normal.

Costings.

The "Costs of Production" of five crops were ascertained during the year. These are presented in a simple form in the following summary, and another Table is added to show the monthly distribution of the labour employed on each crop.

SUMMARY OF COSTS OF PRODUCTION OF CROPS ON NGETTA FARM.

COSTS PER ACRE—HAND CULTIVATION.

MAN-DAYS PER ACRE.

	1928-29. <i>Cotton.</i>	1929. <i>Maize.</i>	1929. <i>Groundnuts.</i>	1929-30. <i>Simsim.</i>	1929. <i>Bulo.</i>
1. To cultivate stubble ...	5	7	5	8	8
2. " second cultivation ...	5	8	4	...	...
3. " plant ...	7	5	10	8	4
4. " re-sow gaps ...	2	1	3	...	...
5. " first weeding ...	9	4	5	7	8
6. " second " ...	7	2	4	...	...
7. " third " ...	4	...	...	...	...
8. " thinning out ...	1	1	1	...	...
9. " harvest ...	51	12	55	32	50
10. " dry and store ...	...	2	3	...	2
11. " burn plants ...	2	...	...	...	...
12. " strip cobs ...	...	6	...	...	...
13. " shell with hand sheller ...	...	8	...	...	...
14. " thresh simsim ...	...	...	...	5	...
	93	56	90	60	72
Labour costs valued at 40 cents per day ...	Shs. cts. 37 20	Shs. cts. 22 40	Shs. cts. 36 00	Shs. cts. 24 00	Shs. cts. 28 80
Seed costs ...	—	20 lbs. @ 3 cts. =Sh. 0/60.	21 lbs. @ 20 cts. =Sh. 4/20.	10 lbs. @ 10 cts. =Sh. 1/-	10 lbs. @ 10 cts. =Sh. 1/-
TOTAL COSTS PER ACRE ...	Shs. cts. 37 20	Shs. cts. 23 00	Shs. cts. 40 20	Shs. cts. 25 00	Shs. cts. 29 80
Yield per acre ...	362 lbs. "Good" 140 lbs. "Stained"	1,734 lbs. (shelled).	949 lbs. (unshelled).	320 lbs. (grain).	1,726 lbs. (heads)
Local market price per pound ...	"Good" 20 cts. "Stained" 7 cts.	3 cts.	8 cts.	10 cts.	6 cts.
Value of yield or gross return ...	Shs. cts. 82 29	Shs. cts. 52 02	Shs. cts. 75 92	Shs. cts. 32 00	Shs. cts. 103 56
Profit per acre ...	45 00	29 02	35 72	7 00	73 76

REMARKS.

Cotton:—After groundnuts. June sown, 4 ft. by 1½ ft.; average of 4 acres.

Maize:—After Kapenda. Var. "Hickory King" 3 ft. by 2 ft. Badly damaged by ants; yield should be double. Average of 2 acres.

Groundnuts:—After cotton. 2 ft. by 2 ft. Yield below normal owing to drought. Average of 2 acres.

Bulo:—After cotton. Average of 2 acres.

Simsim:—After sweet potatoes. A poor yield. Average of 3 acres.

NOTE:—The following costs are not included:—

- (i) Supervision.
- (ii) Wear and tear of tools and of maize sheller.
- (iii) Proportion of original cost of stumping and clearing.

DISTRIBUTION OF LABOUR PER MONTH.

Month.		Cotton.		Maize.		Groundnuts		Simsim.		Bulo.
January	...	20	...	—	...	—	...	5	...	—
February	...	6	...	—	...	—	...	—	...	—
March	...	2	...	—	...	—	...	—	...	—
April	...	—	...	7	...	9	...	—	...	12
May	...	5	...	19	...	13	...	—	...	8
June	...	12	...	2	...	5	...	—	...	8
July	...	11	...	—	...	5	...	—	...	—
August	...	8	...	—	...	—	...	16	...	52
September	...	4	...	28	...	—	...	7	...	—
October	...	1	...	—	...	55	...	—	...	—
November	...	8	...	—	...	3	...	—	...	—
December	...	16	...	—	...	—	...	32	...	—
TOTAL		93	...	56	...	90	...	60	...	80

These costings must be repeated over a number of years before any reliable information can be ascertained, as the object in view is not so much the determination of the possible profitableness of marketable crops, though that factor is admittedly of prime importance, but rather the determination of crop demands in terms of man-days.

It is hoped that the time is approaching when the peasant farmer will settle on cleared holdings, when he will need to practice a definite rotation of crops. Reliable advice on a crop rotation must be based on two principles, first, the proper sequence of the crops in the rotation, and second, the possible maximum area of the rotation in relation to human capacity. The former is being discovered by a series of experiments conducted at Serere; the latter can be ascertained through costings.

The object of these costings, therefore, is to discover, firstly, the total number of man-days required in the production of each crop, and secondly, the number of man-days the crop needs per month.

The annual capacity of the labourer in terms of man-days is easily determinable after deducting holidays and the days necessary for luwalo, etc., and therefore on a basis of man-days it is possible to correlate crop demands with the labour supply of the ordinary porter.

Another problem also needs to be considered, namely, that the labourer himself is not the unit of power on a native farm, the unit is the family. An attempt to determine the output capacity of a family-unit was made on Ngetta Farm during the year. A block of four acres was stumped and cleared for the purpose of a model holding. One of the best and most reliable porters on the farm, a married man with two children, was selected as tenant. It was arranged that he should be paid his previous wage on the understanding that he allowed the farm headman to keep a daily diary of his holding. All crops grown by him were to be his own property, but he was not permitted to employ hired help. Unfortunately the scheme was a failure. The tenant disliked working on his own, he soon became very indifferent towards work, and after he had planted one acre of bulo and one-quarter acre maize he requested to be allowed to abandon his holding and to resume his previous occupation on Ngetta. No other course being possible at the time, the holding had to be abandoned.

It is regrettable that this scheme was a failure, as a model holding is the most desirable method of obtaining information, especially with regard to yields under native management, and the proportion of crop necessary for home consumption. It is hoped to try with another tenant in 1930.

No comment is offered on the costings tabulated above, as they cover only one year's work when weather conditions were also abnormal. It is proposed to repeat the work in 1930 and to include a section to determine the comparative costs of ox-drawn implements.

Seed Distribution.

The seed of maize and groundnuts will be distributed in the Lango district in 1930.

Two plots of one acre each will be prepared in every Magoro (Muluka) and seed of maize and groundnuts from Ngetta will be planted in each acre. The yield from these plots will be sufficient for a distribution to the peasants in 1931 of a supply of 10 lbs. seed per head for use on their own plots.

This method will be repeated every year to guarantee a reliable seed supply. Other crops such as simsim, mtama, and kapenda will also be included when any improved variety warrants distribution.

D. STEDMAN-DAVIES,
Agricultural Officer.

ANNUAL REPORT OF COTTON BREEDING SECTION, 1929—1930.

Summary.

The experimental crop at Serere yielded much below the average owing to adverse weather conditions coupled with the ravages of blackarm.

Remarkably low soil temperatures were recorded during the season, especially in the critical months of July and August.

The rainfall was abnormal. June was very dry, while October and December were excessively wet.

Blackarm was undoubtedly a very serious agent in reducing the crop at Serere, the main attack appearing in October. Several semi-resistant types were observed and selected in the breeding plot.

The outstanding feature of the season, from the breeding point of view, was the success of the strain U. 4 which was imported for the first time from South Africa. (Pages 30 and 31).

In the breeding plot itself S.G. 85 a selection from Kagwara in Teso, gave even better results than U 4. Re-selections from both these strains have been made in an attempt to improve the quality of the lint which at present is rather short and harsh. (Page 30).

The strain S.G. 23.8 was grown in a two-acre medium bulk increase plot and again exhibited a low rate of boll shedding. (Page 32).

Trials with S.G. 27, a good quality cotton, were very disappointing, the yield being low in each test.

The results of the variety trials at Serere, Bukalasa, and other outside centres are given on pages 34—36. In all cases Fisher's Analysis of Variance was used in working out the results.

Sowing date and spacing experiments were conducted at Serere, Ngetta, Kamuge and Kaberamaido. The results of these, given on pages 36—39, confirm the results of previous years in showing the value of early planting as against late July and August sowing, and except in the case of Kamuge, the value of closer spacing, *i.e.*, 3ft. by 1ft. as against normal, 4ft. by 1½ft.

The continuous planting experiment was continued and showed up well the beneficial effects of applications of kraal manure to semi-exhausted soil. (Page 39).

A uniformity trial was carried out on one of the new blocks and the results will be of great value in laying out experiments on this plot. (Page 40).

The Mulondo Seed Farm area was used for the first time. The area was planted with S.G. 29 seed and the scheme worked quite satisfactorily except for a small acreage planted.

Samples from the Senior Agricultural Officer's quarter-acre trial plots were examined in the laboratory. No significant differences in yield were obtained, but S.G. 29 showed superiority in general quality.

Insect pests were less serious than usual. Jassids appeared early in the season but disappeared after the abnormal rains.

The quality of lint from the general crop was below normal, chiefly on account of a high percentage of immature cotton being picked.

The lint index and seed weight in Teso and Lango were reduced by from 20% to 40%, this reduction having a considerable effect on the total yield.

General.

(1) STAFF.—Mr. G. W. Nye, Cotton Botanist, proceeded on leave in April, 1929, and returned to Serere in December, 1929. He was granted extension of leave in order to visit the cotton areas of the Sudan.

Mr. H. R. Hosking, Assistant Cotton Botanist, was at Serere throughout the season with the exception of several safaris in connection with the variety trials, and a fortnight in September spent on local leave.

(2) BUKALASA AND SERERE.—Work commenced early in 1930 on the main cotton laboratory which is being erected at Bukalasa. It is expected that this will be completed in August and a full programme of work, including both Bukalasa and Serere, has been drawn up for the coming season. The work at Serere will continue on the same lines as before.

In order that full benefit from having two stations should be obtained, the cotton areas of the Protectorate have been divided up for the purposes of cotton breeding into two zones: (a) elephant grass, comprising South-West Busoga, Buganda Province, and Bunyoro, which will be served by Bukalasa, and (b) short-grass, comprising the rest of the Eastern and Northern Provinces, which will be served by Serere. Permanent variety trial centres are being established within each zone.

(3) NATIVE STAFF.—The work of the native staff has again been very satisfactory. Several of the laboratory boys have reached a high standard of efficiency and are doing very useful work.

The staff was augmented in January by the appointment of two native civil servants trained at Makerere College.

(4) BUILDINGS.—No additions were made to the Serere laboratory during the season. The need for a power ginnery capable of dealing at least with the farm crop has been fully emphasised, the difficulties in preventing mixing of seed in a full-sized ginnery being almost insuperable.

Summary of Meteorological Conditions.

The total rainfall for the season was well above normal, the latter end of the year experiencing very high rainfall coupled with low soil temperatures. July again gave less sunshine than the other months, and the soil temperatures reached a minimum.

May and early June sown cotton experienced a dry spell of twenty days in June, which checked the plants considerably. This was followed by lack of sunshine and low soil temperatures in July. July cotton was planted in a normally wettish month with very low soil temperatures: these were possibly too low for acute blackarm attack. August planted cotton received normal sunshine and rain during its growing period.

The abnormally low soil temperatures from September to the end of the year probably affected the earlier sown cotton more than July and August sown owing to the former having been so severely checked by drought in its early stages.

Month.	Rain.			Sunshine.		Soil Temperatures.
May	...	Slightly above normal	...	Normal	...	Rather low.
June	...	Well below average, the last 20 days receiving only 0.29 ins.	...	Normal	...	Above average.
July	...	Little above normal	...	Very cloudy, very little sun.	...	Abnormally low.
August	...	Below average	...	Normal	...	Normal to cool.
September	...	Above normal	...	Very sunny	...	Low, much below average.
October	...	Record rainfall for this month. Heavy showers	...	Normal	...	Much below average.
November	...	Below average	...	Sunny	...	Still low.
December	...	Record rainfall for the month	...	Below average.	...	Still below normal.

TABLE I.
SUMMARY OF METEOROLOGICAL OBSERVATIONS AT SERERE.

MONTH.	RAINFALL.			SUNSHINE.	SOIL TEMPERATURES.	
	Total monthly. Inches.	No. of days of rain.	Deviation from 1921-29 Mean.		One foot daily means.	Deviation from mean of 1927 and 1928.
1929—						
March	2.23	9	-1.51	8.2	84.9	+0.1
April	10.48	21	+1.56	6.7	80.8	+0.2
May	6.37	18	+0.34	7.6	77.6	-0.5
June	3.24	9	-1.35	7.6	79.5	+1.5
July	5.83	18	+0.81	4.9	75.4	-2.0
August	4.48	14	-1.70	7.5	77.9	+0.2
September	6.60	16	+0.90	8.4	78.1	-3.0
October	9.36	19	+3.86	7.3	78.3	-2.9
November	4.35	8	-0.31	7.9	79.8	-0.7
December	4.74	13	+3.39	6.4	79.6	-3.7
1930—						
January	0.56	6	-0.08	6.6	81.6	-1.4
February	3.57	5	+1.63	7.4	82.3	-3.9
MEAN	61.81	156	+7.54	7.2	79.7	-1.3

Breeding Plot.

A new site for the breeding plot was selected and was situated at the top of the three new ten-acre blocks. The plot was divided into three one-acre plots to allow for a three-year rotation. Unfortunately Plot D, which was used this year, was unsatisfactory, as three rows were badly affected by the avenue of Cedrella on one side of the plot. It has been decided to scrap this plot and to extend further in the other direction.

Part of the plot was dressed with kraal manure with very marked visible effect.

All the progeny rows were sown on July 10th at a spacing of 5 ft. by 2 ft. The first fifteen plants in each row were marked off for selfing. Seventy-nine rows were planted, consisting mainly of new selections including U. 4 from Barberton, and of reselections from S.G. 7 (Salisbury), S.G. 27, S.G. 29, S.G. 23·8 (a low boll shedding strain) and several from the B. series.

The general results were very disappointing, less than half the crop of the previous year being harvested, although the rows were planted on the same day as last year. The chief causes of failure were adverse weather conditions coupled with a severe attack of blackarm.

The original germination was very poor and two resowings were necessary in August. Subsequent growth was very slow and flowering was a fortnight later than last season. Blackarm appeared late in October and rapidly ran through the plot. Careful observations with regard to resistance to this disease were made and considerable variation was observed in this connection. The two highest resisting strains were S.G. 85 and U. 4, which are discussed later. The heavy rains in December enabled the plants to recover from attack, but this was too late to have any effect on the crop. The amount of immature bolls and lint was very high, this being in part due to blackarm and also to excessive rainfall. Picking commenced on 28th November and was continued as usual at five-day intervals. So few sound bolls were obtained that it was impossible to get any results from the boll analysis except in the case of U. 4 and S.G. 85.

Owing to the poor habit of the usual Nyasaland type in this country it has been decided to pay special attention to the development of a more erect type with less straggly monopodia, as a fairly high proportion of the crop must be lost every season by bolls lying right on the ground. The most promising types with regard to this character were an Acala selection and also a reselection from S.G. 15, but unfortunately these were unsatisfactory in other respects.

The reselections from S.G. 7 (Salisbury) were very badly attacked by blackarm and only one strain was retained, this being an off type and showing a certain amount of resistance to the disease.

The S.G. 29 reselections were very poor yielders and only one S.G. 29.9.9 was worth retaining, on account of its comparative uniformity.

Three strains from S.G. 35 (a green fuzzed type) showed resistance to blackarm in that they retained their leaves but their rates of boll shedding were very high. Several selections were made from these.

Reselections from S.G. 23·8 were disappointing as they all gave very high rates of boll shedding, but these results are misleading, as the three families are the ones referred to above which suffered from tree effect.

The most outstanding types were S.G. 85 and U. 4—S.G. 85 was a single plant selection made in the previous season in a native plot at Kagwara. It was very vigorous and had a fairly erect habit. The row showed obvious signs of splitting into two types—the normal Nyasaland type and the S.G. 85 type. This latter showed considerable resistance to blackarm and gave very high yields, one plant giving over 10 ozs. of seed cotton. The lint characters are not too good, the staple being on the short side and the lint rather inclined to be harsh. Several selections were made in the row with the object of improving these characters. The following table gives a summary of the quantitative characters of the selected plants:—

TABLE II.

Plant No.	Total bolls picked.	No. of seeds per boll.	Notes per boll.	Lint wt. per boll.	Lint length mm.	Lint Index.	Ginning outturn.
1 ...	71 ...	33·2 ...	1·8 ...	1·56 ...	31·6 ...	4·7 ...	32·7
7 ...	79 ...	— ...	— ...	— ...	29·2 ...	4·2 ...	34·1
11 ...	100 ...	— ...	— ...	— ...	31·5 ...	— ...	—
16 ...	42 ...	30·8 ...	1·8 ...	1·41 ...	28·6 ...	4·6 ...	32·9
18 ...	49 ...	— ...	— ...	— ...	32·0 ...	— ...	—
20 ...	93 ...	30·5 ...	1·7 ...	1·65 ...	32·4 ...	5·4 ...	33·2
24 ...	105 ...	29·5 ...	2·3 ...	1·45 ...	30·1 ...	4·9 ...	35·9
29 ...	75 ...	32·4 ...	1·4 ...	1·32 ...	29·7 ...	4·1 ...	34·4
34 ...	199 ...	30·8 ...	1·0 ...	1·06 ...	26·5 ...	3·4 ...	31·0

The strain U. 4 is a selection made by Mr. Parnell in South Africa from a strain of cotton which originally came from Uganda. In practically every country it has been tried in it has fully lived up to its reputation in being a heavy cropper on poor soils, in Jassid resistance and in resistance to drought. In this, its first trial in Uganda, it exhibited all these characteristics, including resistance to blackarm. A progeny row and also a small bulk increase plot was planted

DIAGRAM 1.

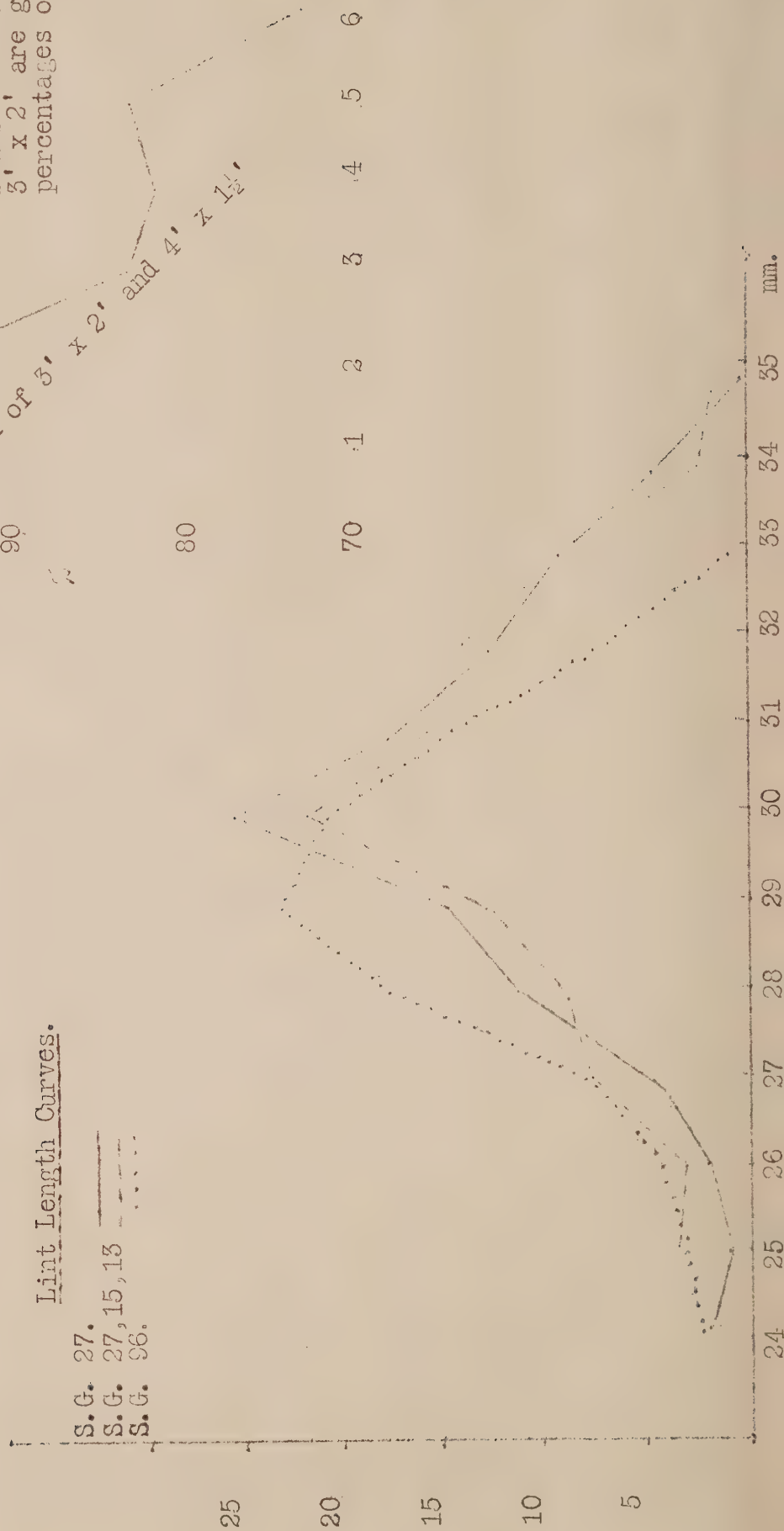
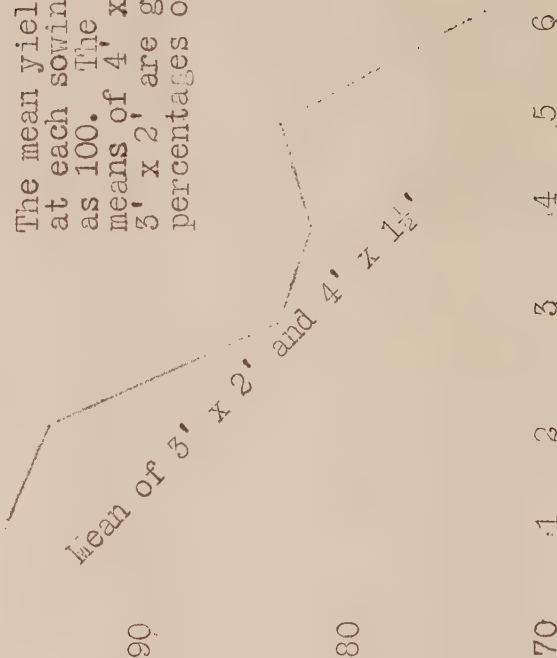


DIAGRAM 2.
 $\frac{3'}{2'} \times \frac{1'}{1'}$



The mean yield for $3' \times 1'$ at each sowing is expressed as 100. The corresponding means of $4' \times 1\frac{1}{2}'$ and $3' \times 2'$ are given as percentages of 100.

with this strain and the results are fully discussed under the heading "Increase Plots." Several plants were selected in the progeny row with the object of improving the staple and quality of lint which at present is short and harsh.

Reference Plot.

Two row plots of a number of varieties for reference purposes were planted at the same time as the breeding plot.

Allen.—Although this was not selfed previous to 1924 this strain has kept comparatively true to type. The plants were fairly erect and a fairly good yield was obtained from them.

Sunflower.—This type is now very mixed and probably very little of the original material remains. The plants were very straggly and yielded badly. The little lint that was produced was of very good quality.

Arizona.—This variety yielded fairly well but its lint was very short and harsh.

Meade.—Some extraordinarily good plants appeared in the plot. Two selections were made, each of which yielded well and had very good lint.

Kasch, Mebane, Acala, Bancroft and Sea Island.—All these types were complete failures. Blackarm killed most of the plants and hardly a sound boll was produced amongst them.

Multiplication.

(a) SMALL BULK INCREASE PLOTS.—

S.G. 96 (S.G. 27.15.13.5).—This is the produce of a single plant (No. 5) in progeny row S.G. 27.15.13 of the previous season. Sufficient seed was obtained from this plant to plant 1/9th acre, which was done in July. Unfortunately the plot chosen was subject to a great amount of wash, with the result that many plants were completely torn out of the ground and in addition the soil was poor and shallow, so that the resulting yield at the rate of 109 lbs. per acre is not unduly low. This strain, having been selfed and selected for four generations, is approaching fixity of type and will be very useful as a standard for reaction to weather conditions from year to year. Most plants were badly attacked by blackarm. The following characters were recorded.—

Lint Length.	Seeds per boll.	Motes per boll.	Lint Index.	Wt. of 100 seeds.	G.O.T.
29.28 ± 0.16 s.d. 1.65 ...	30.3 ...	2.7 ...	3.93 ...	8.51 ...	31.5

The lint is fairly strong, silky and regular.

S. G. 27.15.13.—This strain is the parent family of S.G. 96. It yielded very well in the breeding plot of the previous season and its lint characters were very desirable. One quarter-acre plot was sown in early July and an additional one in August. The latter plot yielded very badly again demonstrating the inadvisability of late planting at Serere. The yields were as follows:—

July sown ..	...	...	..	348 lbs. per acre.
August sown ..	..	...	...	54 ,, ,, ,,

Blackarm attacked the plants severely in October but they recovered in January.

The following characters were recorded:—

Lint Length.	Seeds per boll.	Motes per boll.	Lint Index.	Seed Weight.	G.O.T.	Bolls per plant.
30.07 ± 0.17 s.d. 2.12 ...	30.5 ...	2.7 ...	3.91 ...	8.84 ...	30.9 ...	14.7

It will be noted that its characters are very similar to those of S.G. 96.

Diagram I. shows the lint length curves of the parent strain, S.G. 27, and of these two sub-strains.

U. 4.—The seed of this strain was obtained from Mr. Parnell at Barberton, South Africa. It is a selection made by him from a crop of cotton which had originally been sent to South Africa from Uganda. It has been grown with great success in South Africa, Rhodesia and Nyasaland on account of its drought resistance, resistance to Jassid, and high yielding powers, especially on poor soils. It was tried for the first time in this country in the season under review and was very successful indeed. Enough seed had been obtained to sow a one-quarter acre small bulk increase plot and to include it in the variety trial at Serere.

The one-quarter acre plot was sown in July; germination was very rapid and subsequent growth was vigorous. The plants, although exhibiting considerable variation, were as a whole erect in habit. Flowering and bolling were very prolific and the resulting yield of the plot was at the rate of 1,014 lbs. per acre.

In the variety trial it yielded at the rate of over 500 lbs. per acre and was a significantly higher yielder than any of our bulked strains in the same test.

Considerable resistance to blackarm was shown though individual plants varied considerably in this respect.

The lint is not too good in quality, being very harsh and rather short in staple and much below the standard aimed at in this country. Numerous selections have been made with the object of improving this character.

In the one-quarter acre plot 100 plants were used for observational purposes, and from these the following figures were obtained:—

Flowers per plant.	Bolls per plant.	Percentage bolls shed.	Seed per boll.	Motes per boll.	Wt. of 100 seeds.	Lint Index.	Ginning percentage.	Lint length.
75.6	23.1	62.7	31.9	1.45	80.5	4.36	35.1	28.59±0.26 s.d. 2.06

In the forthcoming season U. 4 will be grown in a three-acre medium bulk increase plot at Serere and will be tried in all the variety trials at Serere, Bukalasa and elsewhere.

S.G. 29.—An isolated one-quarter acre plot of this strain was grown to keep up a nucleus supply of the original seed. It yielded at the rate of 360 lbs. per acre.

(b) MEDIUM BULK INCREASE PLOT.—It was originally intended to run the strain B. 1 up in bulk and a two-acre plot was actually sown, but the spinning test reports received in August were so emphatic as to its poor spinning qualities that it was decided to replace it with S.G. 23.8 which had been well reported on by the spinners and which was the lowest boll shedder so far available. Accordingly, seed of this strain was planted in between the rows of B. 1 and these latter were uprooted as soon as 23.8 germinated. The crop made slow progress and was attacked by blackarm in November, but despite this and the late sowing a yield of 239 lbs. per acre was obtained. Observation rows were used for flower and boll counts, etc., and the figures from these gave a boll shedding percentage of only 54.4%, a very low figure for this season and indicating that this low shedding is a definite character of the strain. Unfortunately, this low shedding rate is coupled with a low flowering rate, and selections are being made to try and improve this without impairing the low shedding character.

This strain was tested out in the variety trials at Serere, Ngetta, Achwa, Labori, Katakwi and Toroma, and the results are summarised below.—

TABLE III.

		HEAVY SOILS.		MEDIUM LIGHT SOILS.					
		Serere.	Labori.	Ngetta.	Achwa.	Katakwi.	Toroma.		
Yields in lbs. per acre	N. 17 ...	284	333	143	42	56	124		
	S.G. 23.8	299	400	73	41	66	92		
Lint length	...	29.4	30.1	28.8	—	29.1	28.7		
Lint index	...	3.2	3.1	2.8	—	3.6	3.7		
Ginning out-turn	...	32.7	33.2	30.0	—	35.6	35.2		

It appears that S.G. 23.8 yields better than N. 17 on heavy types of soil, while on the lighter soils the position is reversed.

The seed is very small and light and the lint index is very low. The general quality of the lint is fair, the staple being rather on the short side.

(c) BULK INCREASE PLOT.—S.G. 27: This is a medium yielding strain with lint of very good quality. The main crop on the Serere experimental farm was planted with it with the intention of providing sufficient seed to plant up the Mulondo Seed Farm area in the next season. Owing, however, to most of the crop being planted in August a very low yield resulted and insufficient seed was produced for Mulondo. At the same time the variety trials showed S.G. 27 to be a definitely low yielder and further multiplication would be inadvisable. Reselections from this strain are in various stages, and it is to be hoped that one will be found which will yield well and at the same time retain the good lint qualities of the original parent. The results from the Serere main crop were as follows:—

Block.	Acreage:	Spacing.	Seed rate.	Yield in lbs. per acre.	Date sown.
3	8	4 ft. by 2 ft.	3½ lbs.	130.2	22—26 August.
5	9	"	"	117.0	17—20 "
8	10	4 ft. by 1½ ft.	"	383.0	28—29 July.

The strain was included in all the variety trials and the results are summarised below:—

	Serere.	Labori.	Katakwi.	Toroma.	Ngetta.
Yield (lbs. per acre)	254	276	56	84	127
Lint length	30.4	31.1	30.1	28.5	29.8
Lint index	3.48	3.32	3.67	3.46	2.73
Ginning out-turn	31.3	30.9	34.2	33.3	26.1

In all cases N. 17 yielded considerably better than S.G. 27.

THE MULONDO "SEGREGATED" AREA.

As outlined in last season's report, the Mulondo peninsula was selected for the "segregated area" for the Eastern Province, being the first step in the scheme for seed distribution.

Every assistance was received from the Administration to ensure success in the first year of working—a road was made from Labori to the Meruka headquarters, where a permanent store was erected for storing seed and seed cotton. Two special lukikos were held by the District Commissioner to explain to the natives concerned what was expected from them.

Two belts of *Euphorbia candelabrum* were planted 1,000 yards apart to provide a safety belt, within which no cotton could be planted; this also formed a useful boundary which no native could cross with seed cotton either to or from Mulondo.

As soon as the scheme was approved, three natives trained at Serere were stationed in the area to ensure proper uprooting and burning of the old crop, to root up any volunteer plants, to distribute, and supervise the planting of the seed, to make a complete register of growers so that a check could be made during the buying period, to encourage proper sorting of the cotton and to assist in the buying of the crop. They carried out this work in a very satisfactory manner and are being retained for the same work in the coming season.

The area was planted with S.G. 29 strain, the seed being obtained from the main crops at Serere and Simsa of the previous season. In addition to the seed for Mulondo, which was issued at the rate of 10 lbs. per plot, 5,000 lbs. of the same strain were distributed to growers on the borders of the Meruka in order to form an extra margin of safety in the event of some natives slipping over the boundaries with cotton to sell at the store. Planting was later than normal owing to a dry early spell, and this was no doubt partly responsible for the comparatively low yield obtained, as June appears to be the best sowing month for this area. The total area sown was 280 acres, which is only just over an acre per taxpayer, a very disappointing result, as an area of at least 400 acres had been aimed at. The crop made good progress but was attacked by blackarm, though not to the same extent as the crop elsewhere. There was a three weeks' drought in August which gave a considerable check to the later planted crop, and this no doubt affected the yield considerably. Very few stainers were observed until the end of the season, when they were too late to do any appreciable harm.

Buying commenced on the 27th January at the same time as the general crop, Messrs. Foster Brothers doing the buying personally, as arrangements had been made for them to buy, gin, and sell the cotton in Liverpool and to obtain special reports from brokers and spinners handling the crop. Samples of seed cotton were taken at various intervals for laboratory examination, and the results are summarised in the Table below.

TABLE IV.
SUMMARY OF COTTON SAMPLES FROM MULONDO.

<i>Date taken.</i>			<i>Lint length</i>		<i>Lint index.</i>	<i>Seed weight.</i>		<i>G. O. T.</i>		
January 27th	...	...	31.27	s. d. 2.25	...	4.75	...	9.08	...	32.1
February 3rd	...	...	31.16	" 2.23	...	4.29	...	8.80	...	32.6
February 10th	...	...	31.15	" 2.87	...	4.15	...	8.78	...	32.1
February 27th	...	...	31.06	" 1.89	...	4.04	...	7.94	...	33.7
March 7th	...	...	30.44	" 2.09	...	4.07	...	8.37	...	32.7

It is interesting to note the steady drop in staple, lint index and seed weight as buying proceeded. The general quality of the crop was good and considerably better than the general crop in Teso.

The total crop sold was 70,617 lbs. of 1st quality cotton and 6,775 lbs. of low grade cotton, giving a grand total of 77,393 lbs., this being equivalent to a yield of 276 lbs. per acre. This is a very satisfactory yield considering the season, but is much below the average for this area.

The crop was ginned by Messrs. Foster Brothers at their Kasilo ginnery where no other cotton was ginned this season. The ginnery was thoroughly cleaned out and there was little chance of mixing with odd seeds from last year. The crop ginned out very well, giving a ginning percentage of 31.16%. A total of 54 bales of 1st quality was produced and these are being sent to Liverpool under special marks for brokers' and spinners' reports.

Considering this is the first season of working this area, the results are satisfactory except for the disappointing acreage. Special efforts will be made next season to increase the acreage considerably. It is clear, however, that the present position with regard to Mulondo as a seed farm unit is not wholly satisfactory—very little control can be exercised over the acreage planted so that there is always the uncertainty of obtaining sufficient seed for the next stage in distribution. There is also the possibility, despite very careful safety measures, of mixing

occurring, owing to natives being unable to resist the temptation of slipping over into Mulondo from the border with their cotton to sell, thereby saving a twelve-mile walk to the nearest ginnery. Other factors may arise to reduce the acreage, such as a shifting population, outbreaks of plague, and so on. Under present conditions, owing to the scattered nature of the plots, the supervision entailed is considerable, and efforts are being made to persuade the growers to concentrate their cotton in a few large blocks.

In this next season the area will again be planted up with S.G. 29. Of this season's crop 45,106 lbs. of S.G. 29 seed from Mulondo have been handed over to the Field Division for distribution.

Variety Trials.

(a) SERERE.—It was decided to use a portion of the previous year's sowing date and spacing trial for the variety trial; after the cotton was uprooted and burnt from this portion the plots were sown with bulo (*Eleusine coracana*). A good stand resulted, and this was ploughed in at the end of June and cross-ploughed four days later. The area was disc-harrowed on July 10th. Heavy rains in mid-July allowed the bulo to make new growth and as a result some of the straw had to be carried off before planting, as it decomposed too slowly.

Eight varieties were included in the trial—N. 17, S.G. 7, S.G. 26, S.G. 27, S.G. 29, S.G. 23·8, B. 1, and U. 4.

An 8 ft. by 8 ft. Latin square was adopted as being the most suitable layout. The plots were 36 ft. by 33 ft. (approximately $\frac{1}{36}$ th acre). Nine rows of 22 plants each were sown per plot at a spacing of 4 ft. by $1\frac{1}{2}$ ft., the rows being sown across the direction of the slope, which was very marked. Alleys 6 ft. wide were left between the plots, and by keeping these rough little wash was experienced.

Previous to planting, each hole was marked by a short stick, and at sowing, the seeds were planted at the bases of the sticks. As the seeds germinated the sticks were removed and stand counts made by deducting the number of sticks left from 198—the possible number of holes per plot.

All plots were sown on July 27th, six seeds being sown per hole. Two resowings were made, on August 7th and 19th, stand counts being made at the same time. Thinning was done when the plants were about five inches high.

The following table shows the percentage stand for all varieties at the time of first resowing and at the final count:—

TABLE V.

	Variety.						
	U. 4.	S.G. 23·8.	N. 17.	S.G. 7.	S.G. 26.	S.G. 27.	S.G. 29.
Count at first resowing ...	82·6	... 75·4	... 72·0	... 74·8	... 69·6	... 73·2	... 72·7
Final stand ...	97·0	... 97·5	... 96·8	... 98·3	... 92·4	... 97·9	... 98·3

The mean of the final stand was 96·7%.

The first flowers opened on September 28th, when observation rows of ten plants per plot were marked off for daily flower counts.

Picking commenced on December 9th and continued at weekly intervals until February 24th.

The results were as follows:—

Variety.	Mean Seed Cotton per plot in lbs.	Mean 1st Quality Seed Cotton in lbs.
U.4	19·8	10·1
S.G. 23·8	11·0	7·0
N.17	10·4	6·2
S.G. 29	9·8	5·4
S.G. 27	9·4	5·2
S.G. 7	8·4	4·5
S.G. 26	7·9	4·6
B. 1	8·0	5·0
S.E. of Mean	1·164 lbs. or 10·98%	0·790 lbs. or 13·2% of mean.
S.E. Comparison	0·582 " " 5·5%	0·395 " " 6·6% " "

Conclusions:—

Total Seed Cotton.	1st Quality Cotton only.
U. 4 significantly better than all other varieties ...	—
S.G. 23·8 better than all except U. 4 and N. 17 ...	Better than all except U. 4 and N. 17
N. 17 better than S. G. 7, B. 1 and S.G. 26 ...	Better than all except U. 4 and S. G. 23·8
S.G. 29 better than S.G. 7, B. 1 and S.G. 26 ...	—
S.G. 27 better than B. 1 and S.G. 26 ...	—

The picking curves showed that the sixth pick was the peak for U. 4, the seventh for N. 17, S.G. 27 and S.G. 29, and the eighth for S.G. 23·8.

S.G. 23·8, although giving the lowest flowering curve, was second in yield, thus further confirming its low boll shedding habit.

The three strains B. 1, S.G. 7 and S.G. 26 are being discarded as being wholly unsuitable to Uganda conditions.

Variety Trials.

(b) *Other Centres.*—The main work in Teso, apart from Serere, was concentrated on an effort to improve the cotton yield in the counties of Usuku and Nepak. Variety trials were carried out at Katakwi and Toroma, and at the former centre a few progeny rows and a mixed plot of all types of cotton were grown. As in previous years, these trials were practically a complete failure, except that they again showed clearly that under existing conditions cotton is not an economic crop in such an area. Blackarm was very bad on all the plots, and in December most of the plants were merely bare sticks.

There appears to be a hard pan 10 to 12 inches below the surface of the soil through which the roots of the cotton plant are unable to penetrate. The root system is thus poorly developed and the plants suffer readily from physiological drought, a condition which is confirmed by the appearance of the plants.

No significant differences were obtained between any of the varieties tried at Katakwi and Toroma. The progeny rows at Katakwi, which included a row of U. 4, were a complete failure.

The yields per acre calculated from these trials show clearly the very poor return obtained in this area:—

Centre.	Yield of Seed Cotton per acre. lbs.		Return per acre at Shs. 12 per 100 lbs. Shs. cts.
Achwa (Amuria County)	... 41·6	...	5 05
Katakwi ...	... 56·0	..	6 72
Toroma ...	... 124·0	...	14 90

The trial at Achwa, although not in Usuku County, was on similar soil to the other trials and gave similar negative results.

Labori.—This centre has been chosen as representative of the heavy lake shore soils which give high yields and good quality cotton.

The variety trial consisted of six types—N. 17, S.G. 27, S.G. 29, S.G. 23·8, S.G. 7 and B.1.

The layout adopted was one of six random blocks.

The plots were sown on July 30th—late for this area—at a 4 ft. by 1½ ft. spacing. Germination was very bad owing to lack of rain, and resowing was done on September 5th, after which a fair stand was obtained.

The general yield of the crop was much below the average, but the drop was proportional to the rest of Teso. The quality of lint was good, the staple being about 1mm. longer than at Serere.

The results were as follows.—

YIELD OF SEED COTTON PER PLOT IN LBS.

	Variety.						S. E. of Comparison.
	N. 17.	S.G. 7.	S.G. 27.	S.G. 29.	S.G. 23·8.	B. 1.	
Yield per plot (1/52 acre) ...	6·4 ...	5·1 ...	5·3 ...	5·7 ...	7·7 ...	5·2 ...	0·178
Yields expressed as percentage of mean ...	108·4 ...	86·4 ...	89·8 ...	96·6 ...	130·5 ...	88·1 ...	3·1%

Conclusions:—

S.G. 23·8 gave a significant yield over all other varieties.

N. 17 was significant over S.G. 7, S.G. 27, S.G. 29 and B. 1.

S.G. 29 was significant over S.G. 27, S.G. 7 and B. 1.

There was no significance between the others.

(3) *Ngetta.*—A variety trial was conducted here under the supervision of the Agricultural Officer. Six varieties were grown similar to Labori, the layout being in five random blocks. All varieties suffered badly from blackarm, and as a consequence the yields were very low. The results were as follows.—

	Variety.						S. E. of Comparison.
	N. 17.	S.G. 7.	S.G. 27.	S.G. 29.	S.G. 23·8.	B. 1.	
Yield per plot in lbs. ...	5·67 ...	4·18 ...	5·14 ...	7·08 ...	2·94 ...	3·85 ...	0·249
Yields as percentage of mean ...	118 ...	86·5 ...	106 ...	146 ...	61 ...	80 ...	5·2%

Conclusions :—

S.G. 29 is significant over all other varieties.
 N. 17 is significant over S.G. 7, S.G. 23·8 and B. 1.
 S.G. 27 is significant over S.G. 7, S.G. 23·8 and B. 1.
 All varieties are significant over S.G. 23·8.

(4) *Kamuge*.—The variety trial was under the supervision of the Agricultural Officer, Mbale, and consisted of four varieties in eight random blocks.

The results were as follows—

	Variety.								S.E. of
	N. 17.	S.G. 29	S.G. 27.	B1.	Mean.				Comparison.
Yield per plot in lbs.	... 2·6	... 2·3	... 2·1	... 1·8	... 2·2				0·244
Yields expressed as percentage of the mean	... 118	... 104	... 95·5	... 81·5	... 100				11·1%

Conclusions :—

N. 17 is significant over S.G. 27 and B. 1.
 S.G. 29 is significant over B. 1.

(5) *Bukalasa*.—Six varieties were tested in a trial carried out by the Agricultural Officer in charge. The types were—Local, S.G. 29 once grown at Bukalasa, S.G. 29 from Serere, S.G. 27 from Serere, B.1 from Serere and N. 3/5 from Bukalasa. The layout was in the form of five random blocks. The plots yielded very badly owing to abnormal weather conditions and severe attacks of blackarm. The results were—

		Variety.												
		Local.	(S.G. 29 Bukalasa.)			(S.G. 29 Serere.)			S.G. 27.	B. 1.	N. 3/5.		Mean	
Yields per plot in lbs	...	1.24	...	1.57	...	1.09	...	1.32	...	1.00	...	2.33	...	1.43
Yields as percentage of mean	...	86.5	...	109.5	...	76	...	94	...	70	...	164	...	100

The analysis of variance showed no significance between variance due to varieties and that due to random errors, so that no conclusions can be drawn from the experiment except that insufficient repetitions were used.

Sowing Date and Spacing Experiments.

(a) *SERERE*.—The area chosen for this experiment was under cotton experiments in the previous season. Bulo was sown over the whole area in March and was dug in by hand on May 2nd. It was then disc-harrowed and finally cultivated with an ordinary harrow on May 11th.

It was decided to try three spacings at each of six sowing dates, making eighteen treatments in all. The spacings were 4 ft. by 1½ ft. (normal), 3 ft. by 2 ft. and 3 ft. by 1 ft., and the sowing dates May 17th, June 1st, June 16th, July 1st, July 16th and July 31st. As it is probable that this experiment will be carried on over a number of years it was decided to adhere rigidly to the planting dates irrespective of the weather conditions on those days. The sowing dates were separated by only fourteen days, so it was decided to omit any resowings, and to ensure a good stand ten seeds per hole were sown. The holes were thinned to one plant per hole by scissors.

The layout adopted was in the form of ten random blocks, each of the eighteen treatments occurring once at random in each block.

Since outside rows had to be broken down at harvest to eliminate competition between adjacent plots of different sowing dates, it was necessary to compensate the plot in such a way that equal areas would be picked from each plot thus:—

Spacing.	No. of rows planted.	No. of rows harvested.	Plants per row sown.	Plants per row harvested.	Area harvested per plot. sq. ft.
4 ft. by 1½ ft.	9	7	20	17	720
3 ft. by 2 ft. ...	12	10	15	12	720
3 ft. by 1 ft. ...	12	10	29	24	720

The extra six square feet needed to bring the 4 ft. by 1½ ft. plots up to 720 sq. ft. was obtained by not breaking down one of the outside row plants in each plot.

The rows were planted across the direction of the slope and each pair of plots was surrounded by a small ditch.

A considerable number of blanks was caused by rats digging up the seed before it germinated and also by young plants being washed away by heavy showers.

TABLE VI.
Summary of Variety Trials.
 (a) TESO DISTRICT.

Variety.	Serere.			Labori.			Achwa.			Katakwi.			Torona.		
	Yield per acre. lbs.	Lint length mm.	Lint Index.	Yield per acre. lbs.	Lint length.	Lint Index.	Yield per acre. lbs.	Lint length.	Lint Index.	Yield per acre. lbs.	Lint length.	Lint Index.	Yield per acre. lbs.	Lint length.	Lint Index.
N. 17 ...	284	29.5	3.5	333	30.4	3.4	42	29.6	2.8	56	29.6	3.3	124	29.6	3.02
S.G. 27 ...	254	30.4	3.5	276	31.1	3.3	30	—	—	56	30.1	3.7	84	28.5	3.50
S.G. 29 ...	265	30.8	3.8	283	31.2	3.5	39	31.1	2.8	62	29.9	3.2	62	29.8	3.80
S.G. 23.8 ...	299	29.4	3.2	400	30.1	3.1	41	—	—	66	29.1	3.6	92	28.7	3.70
S.G. 7 ...	229	—	—	265	—	—	40	—	—	66	—	—	94	—	—
U. 4 ...	536	28.9	4.4	—	—	—	—	—	—	—	—	—	—	—	—
B. 1 ...	217	31.2	3.5	270	—	—	—	—	—	36	—	—	—	—	—

Owing to excessively dry conditions in June, the June 16th and July 1st sowing dates germinated at the same time and consequently there was no difference between their yields.

The summary of the results is given in the Table below.

TABLE VII.
MEAN YIELD PER PLOT IN LBS. OF SEED COTTON.

Sowing Date.	Spacings						Sowing Date
	4 ft. by 1½ ft.	3 ft. by 2 ft.	3 ft. by 1 ft.	Means.			
May 17th	... 3·52	... 3·34	... 3·50	... 3·45			
June 1st	... 3·52	... 3·36	... 3·59	... 3·49			
June 16th	... 4·06	... 4·11	... 4·87	... 4·35			
July 1st	... 4·33	... 4·33	... 5·28	... 4·64			
July 16th	... 3·52	... 3·83	... 4·42	... 3·92			
July 31st	... 1·91	... 2·06	... 2·69	... 2·22			
Spacing means	... 3·48	... 3·51	... 4·06	... 3·68			

The following results were obtained:—

From the analysis of variance the standard error of comparison was 0·356 lbs. or 9·7% of the mean, and the standard error of the whole experiment was 0·796 lbs. or 21·6% of the mean.

The variance due to sowing dates was highly significant over random errors, while the variance due to spacings and interaction of sowing date and spacing were not significant.

Conclusions:—

(a) Sowing dates—

All sowings are significant over July 31 planting.

No significance between May 17th and June 1st and none between June 16th and July 1st.

June 16th is significant over May 17th, June 1st and July 31st.

July 1st is significant over all sowings except June 16th.

(b) Spacings—

There is no significance between the three spacings, irrespective of sowing date.

3 ft. by 1 ft. is significant over the others in the June 16th and July 1st sowings, and is significant over 4 ft. by 1½ ft. in the July 16th and July 31st sowings.

This is the first time out of five consecutive sowing date trials that the earliest sowings have not shown a marked superiority over the others, but at the same time this experiment confirms the others in showing that planting after the middle of July is accompanied by a considerable reduction in yield.

Diagram 11 shows the nature of the interaction between the dates of sowing and spacings. It can be seen that the superiority of 3 ft. by 1 ft. spacing over the others is emphasised in the later sowings.

Sowing Date and Spacing Experiments.

(b) OTHER CENTRES.—Sowing date and spacing experiments were carried out under the supervision of the Agricultural Officers concerned at Bukalasa, Ngetta, Kamuge and Kaberamaido. No results were obtained at Bukalasa owing to the failure of the crop.

(1) *Kamuge (Bugwere District)*.—In this trial two spacings, 4 ft. by 1½ ft. and 3 ft. by 1 ft., were tried at each of four sowing dates. The layout adopted was in the form of random blocks, five blocks being used.

The results were as follows:—

YIELDS OF SEED COTTON IN LBS. PER PLOT.

Spacing.	Sowing Date.								Mean.
	May.	June.	July.	August.					
4 ft. by 1½ ft.	... 7·25	... 2·70	... 1·39	... 1·50	... 3·20				
3 ft. by 1 ft.	... 5·90	... 3·45	... 1·80	... 0·85	... 3·00				
Mean ...	... 6·57	... 3·08	... 1·58	... 1·18	... 3·10				

The standard error of comparison was 0·33 lbs., or 10·6% of the mean.

The analysis of variance showed high significance for interaction of sowing date and spacing and also for sowing date.

Conclusions:—

May sowing was significant over all other dates at each spacing.

June sown was significant over July and August at all spacings.

Normal spacing is significant over closer spacing at May planting.

(2) *Ngetta (Lango District)*.—A similar trial to the above was conducted with the omission of August sowing, the layout being in the form of six random blocks.

The results were as follows:—

YIELDS OF SEED COTTON IN LBS. PER PLOT.

Spacing.		Sowing Date.					Mean.
		May.		June.	July.		
4 ft. by 1½ ft.	...	10.55	...	3.35	...	2.35	5.41
3 ft. by 1½ ft.	...	13.72	...	4.83	...	5.20	7.91
Mean	...	12.13	...	4.09	...	3.77	6.66

The standard error of comparison was 0.78 lbs. or 11.6% of the mean.

Conclusions:—

May sowing is significant over June and July irrespective of the spacing.

3 ft. by 1 ft. spacing is significant over normal at all sowing dates.

The interaction between spacing and sowing date is not significant.

Continuous Planting Experiment.

The ten plots of this experiment have been under cotton for five seasons out of six, this season making the fourth successive year under cotton. The ten plots were divided into two series—five received an application of 1,800 lbs. of kraal manure each and the others were unmanured. All the plots were sown on July 5th with S.G. 27 seed.

The individual plot yields were as follow.—

		Unmanured.		Manured.	
		lbs.		lbs.	
1/20th acre plots:—		9.41	...	20.91	
		14.21	...	18.27	
		12.08	...	16.24	
		15.20	...	22.30	
		15.04	...	24.66	
Mean	...	13.19	...	20.48	

The difference between these two means is very significant, P. being less than 1%.

In the previous season the means were—Unmanured 17.3, manured 20.6; these were also very significant.

It is noteworthy that the manured showed a decrease of 0.12 lbs. only per plot as compared with last season, while the unmanured gave a decrease of 4.11 lbs. per plot.

The difference in appearance of the plants in the two series was very marked, the manured plots showing more vigour and ability to recover from blackarm, while the unmanured plants were killed out and were merely dried sticks at the end of the season.

Germination Tests.

In order to ascertain the viability of badly blackarm-infested seed a few tests on the germination of Teso samples were conducted. The following are some of the results:—

Rappayi Ginnery	...	...	...	62.0% germination.
Achuna	..	...	...	74.5 "
Achuna treated with sulphuric acid	...	...	...	88.0 "
Mulondo	...	...	...	67.5 "

These results compare favourably with those of other years and indicate that the loss of viability through blackarm is not very great.

Bud and Boll Shedding Investigation.

This was continued at Serere on more detailed lines and another similar one was carried out at Kampala by the Assistant Entomologist, to whom the writers are indebted for the results.

For the purposes of collection of shed buds and bolls two rows of twenty plants were selected, and on either side of each row a strip of fine wire gauze was laid on the ground, the two pieces overlapping and a small hole being left for the stem of the plants. Buds and bolls shed were collected by hand from the wire every morning and afternoon and these were classified in the laboratory into various sizes according to the width of the bracts in the case of the buds, and to the width of the actual boll, in the case of bolls. Daily flower counts were also made. The results from Serere and Kampala were plotted in curves and then correlated with weather conditions. It was at once obvious that the main cause of bud shedding was rain, the rain peaks and the peaks of highest shedding coinciding in every case. Evidence was also present that a certain amount of bud shedding was due to wind, especially at Serere in November. The boll shedding, while being correlated to a certain extent with rainfall, was in the main due to some other external influences such as insects or disease. From the tables below it is seen that the greatest loss in potential crop occurs through bud shedding.

TABLE VIII.

BOLLS AND BUDS SHED PER PLANT (TOTALS).

			5 mm.		8 mm.		12 mm.		16 mm.		24 mm.		Over 24 mm.	Total.		
Buds	...	Serere	...	25.8	...	6.6	...	5.0	...	3.9	...	4.0	...	1.0	...	45.3
		Kampala	...	57.0	...	15.6	...	8.1	...	6.8	...	4.9	...	1.9	...	96.3
Bolls	...	Serere	...	—	...	15.1	...	2.5	...	0.7	...	—	...	—	...	18.5
		Kampala	...	—	...	5.7	...	3.5	...	1.1	...	0.5	...	0.1	...	10.9

By far the greatest proportion of the buds shed were 5mm. or under, which result is similar to that obtained by Bailey in Egypt and the Sudan.

The following table gives a summary of the results—

TABLE IX.

Centre.	Total buds shed.	Total flowers produced.	Total bolls shed.	Potential crop bolls.	Actual crop bolls.	Percentage of				Crop shed. Total.
						potential crop produced.	Potential percentage.	Buds.	Bolls.	
Serere ...	45.3	... 26.3	... 18.5	... 71.6	... 7.8	... 10.8	... 63.3	... 25.9	... 89.2	
Kampala ...	96.3	... 24.4	... 10.9	... 120.7	... 13.5	... 11.0	... 79.6	... 9.1	... 89.0	

It is interesting to note that although the proportion of buds and bolls shed differed considerably in the two centres, yet the total percentage of crop shed was the same in each case.

Uniformity Trial.

Early in 1929 it was decided to centralise all plot experiments, consequently three new adjacent ten-acre blocks were opened up. This seemed a good opportunity to carry out a "uniformity" trial with cotton on the first of these three new blocks—block "A"—during the 1929—30 season. It was hoped that a preliminary trial of this description would give some information as to the most economical size of plot and type of lay-out for the piece of land in question.

About eight acres of block "A" were sown with cotton at 3 ft. by 3 ft. spacing during the last week of July. As the time for picking approached, the whole block was divided into square plots of 1/40th of an acre each—that is, eleven rows of eleven plants in each plot. The corners of each of these unit plots were marked with white posts. At picking, ropes were tied to these posts, to demarcate the individual plots. Three hundred of the unit plots were picked in all; they were arranged in twelve rows of twenty-five columns each.

Owing to the available labour being employed with the normal cotton experiments it was found that the trial could only be picked once. Consequently the plots were left until the end of January, 1930, when harvesting was commenced. After 120 plots had been picked the station experienced an unexpected week of heavy rain at the beginning of February—3.51 inches fell in five days, the mean for the month of February being 1.94 inches. The remaining 180 plots were picked during the third week of the month. As a result of this rain it was found that the experiment would have to be treated as two separate trials, as the mean plot yield for those plots harvested before rain was 50.19 as compared with 38.50 for those picked after rain—a loss of over 20 per cent.

The results have not been fully worked out as yet owing to the large amount of calculation involved. In calculating the results the following plot sizes have been employed:—

1. Square 1/40ths.
2. Long 1/20ths running parallel to the rows.
3. Long 1/20ths running parallel to the columns.
4. Square 1/10ths.
5. Long 1/10ths running parallel to the rows.
6. Long 1/10ths running parallel to the columns.
7. Long 1/5ths running parallel to the rows.
8. Long 1/5ths running parallel to the columns.

The results obtained so far show that the smallest size of plot is the most economical, as the slight increase in precision gained by the use of much larger plots is not in proportion to the increased land and labour required.

The "Latin square" is the safest type of lay-out; this is to be expected, but properly arranged random blocks give just as good results, in many cases, with rather more repetitions. Long plots are not as good as square ones on the whole on the particular block in question.

The site of old ant-hills do not cause a very marked difference in fertility, but the effect of wash off ant-hills which have not been properly levelled is very marked. The patches where gravel is close to the surface also show a decided drop in fertility.

The experiment has been of value in showing that small plots, and therefore less land and labour are efficient for accurate plot experiments with cotton on this particular piece of land. Further, the experiment has shown which is the most sensitive type of lay-out for the cotton variety trial in the coming season.

Notes on the Buganda Crop.

A tour of the chief cotton areas in Mengo and Entebbe districts was made by the senior writer in order to become acquainted with cotton growing conditions in that area prior to being transferred to Bukalasa.

The general condition of the crop was much better than the Eastern Province. Blackarm was present but it did not appear to be responsible for much loss of crop except in the dry area in North Bulemezi. Excessive rains in December and January had resulted in a great amount of bud and boll shedding and a comparatively small crop was being harvested, except near Nakifuma, where a very fine crop had been produced. In most places visited the earlier sown cotton appeared to be giving a much better yield than the late sown crop.

Samples of seed cotton were taken in typical areas for laboratory examination and the results are summarised in the table below. The general quality of the crop appeared good, but there was a considerable quantity of immature cotton present. The lint index and seed weight were normal. The staple was good but rather irregular, and indicates a considerable mixing of strains of cotton.

TABLE X.

SUMMARY OF SAMPLES EXAMINED FROM BUGANDA (GROUPED INTO COUNTIES).

<i>County.</i>		<i>Lint length (mm).</i>		<i>Wt. of 100 seeds.</i>		<i>Lint Index.</i>		<i>Ginning Out-turn.</i>
Kyagwe	...	30.29	...	11.01	...	5.47	...	33.2
		s. d. 2.47						
Bulemezi	...	29.98	...	10.66	...	5.20	...	33.0
		s. d. 2.51						
Mawokota	...	30.75	...	10.87	...	5.15	...	32.2
		s. d. 2.34						
Katambula	...	27.94	...	10.71	...	5.03	...	31.9
		s. d. 2.14						
Gomba	...	29.18	...	10.55	...	5.22	...	32.9
		s. d. 2.12						
Busuju	...	30.30	...	10.79	...	5.00	...	31.6
		s. d. 1.81						

Notes on the Eastern Province Crop.

Samples received for examination consisted mainly of those from the quarter-acre trial plots which are discussed elsewhere in this report. The general quality of the crop was fair, the lint was rather weak, owing to an unusual amount of immature cotton; the staple was rather shorter than usual, especially in Lango. The most remarkable feature of the crop as a whole (S.W. Busoga excepted) apart from the very low yield was the great reduction in seed weight and lint index, amounting to a drop of up to 40% as compared to normal years. The cause was probably a combination of bad weather and blackarm giving rise to interference with the food supply of the seed at a critical period. The reduction in lint index can be subdivided into lower individual hair weight and fewer hairs per seed. Several samples were examined, and the results are as follows:—

<i>Sample.</i>		<i>Lint Index.</i>		<i>Wt. of 100 hairs.</i> <i>grms.</i>		<i>No. of hairs per seed.</i>
A	...	2.30	...	0.000195	...	11,800
B	...	4.60	...	0.000345	...	13,330
C	...	5.71	...	0.000414	...	13,800

The effect of reduction in seed size is being made the subject of a special investigation. A germination test on different sized seed from the same sample gave the following results:—

<i>Seed size.</i>		<i>Wt. of 100 seeds.</i>		<i>Germination percentage.</i>
Normal	...	10.19	...	73.0
Small	...	5.68	...	61.0

Quarter-acre Trial Plots of S.G. 29 and N. 17.

A series of one-quarter acre trial plots of N. 17 and S.G. 29 were laid down by the Senior Agricultural Officer throughout the Eastern Province to provide a rough estimate of the comparative merits of the strains N. 17 and S.G. 29, and at the same time to provide a picture of the variations in yield and quality within the province.

Fifty centres were selected as being as representative as possible of the main soil and climatic conditions in each district. At each centre one-quarter acre plot each of S.G. 29 and N. 17 were planted, the sowing being done on the same day throughout the province.

The writers are indebted to the Senior Agricultural Officer and the Agricultural Officers concerned for the results from these plots, and for the samples which have been examined in the laboratory. Thanks are also due to the Empire Cotton Growing Corporation, and the brokers and the spinners concerned, for arranging for reports to be made on a number of these samples.

Total yields of seed cotton were obtained and these were treated as if the whole series was a large variety trial laid out in random blocks. The statistical analysis gave no significance, which was rather to be expected, as the yields varied enormously within each district, but it seems indicated that S.G. 29 is slightly the better yielder on heavy types of soil, while N. 17 is slightly better on the lighter sandy soils. On the whole, S.G. 29 seems to be better in quality than N. 17.

The table below gives a summary of the results obtained:—

TABLE XI.

District.	No of centres.			Yield per acre.				Lint Length			Lint Index			
				N. 17		S.G. 29		N. 17	S.G. 29	N. 17		S.G. 29		
				lbs.		lbs.								
Teso	...	10	...	183	...	200	...	29.6	...	30.5	...	3.34	...	3.56
Busoga	...	10	...	591	...	614	...	30.4	...	31.0	...	4.16	...	4.44
Lango	...	8	...	259	...	280	...	28.9	...	29.4	...	3.26	...	3.38
Budama*	...	6	...	312	...	323	...	—	...	—	...	—	...	—
Bugishu*	...	3	...	255	...	276	...	—	...	—	...	—	...	—
Bugwere*	...	10	...	222	...	219	...	—	...	—	...	—	...	—

*The samples so marked arrived too late for examination.

The Sudan.

Through the courtesy of the Sudan Government and the Empire Cotton Growing Corporation, the senior writer was enabled to return from leave through the Sudan, where he carried out a programme arranged by Mr. Bailey, Plant Breeder, which included a stay at the plant breeding centre, Shambat, where the opportunity was taken to become acquainted with Mr. Bailey's methods, and visits to the Gezira Research Farm at Wad Medani, the Sudan Plantations Syndicate on the Gezira, and to the rain grown cotton area near Gedaref. The opportunity was also taken while passing through Egypt to pay a visit to the Egyptian Cotton Research laboratories at Giza. A great deal of valuable information was obtained during this trip and it has been of great assistance in drawing up the revised scheme of breeding for Bukalasa and Serere. The writer is glad of the opportunity to express his thanks to the Sudan Government, to the Empire Cotton Growing Corporation, and to Mr. Bailey for all the assistance and facilities which were so readily forthcoming during this tour.

During January, Mr. Bailey visited this country and spent a few days at Serere, when the opportunity was taken to discuss with him several of the most pressing problems.

Conclusion.

The writers wish to record their appreciation of the assistance received from the Administration with regard to the carrying out of the variety trials and to the start made with the Mulondo Segregated Area.

G. W. NYE,
Cotton Botanist.

H. R. HOSKING,
Assistant Cotton Botanist.

ANNUAL REPORT OF THE ENTOMOLOGIST.

1. Both the Entomologist and his assistant have been on duty the whole of the year.
2. All technical details are excluded from this report. They will be embodied in appropriate publications as opportunities occur.
3. For inspection and advisory purposes, forty-seven visits have been paid to non-native estates in Kyagwe, Masaka, Toro and Masindi districts. As in previous years, numerous plots of native cultivation have been inspected. A visit was paid during January to the Bwamba native coffee area to investigate the reported danger of introduction into Toro of coffee berry insects by means of the crop brought over the mountain for sale in Fort Portal. Demonstrations of the method of spraying with sodium arsenite bait for control of the coffee bug have been given to planters in Toro.
4. The Assistant Entomologist has been engaged mainly on experimental work in connection with insects on cotton. Lack of staff has restricted his field work to areas within a radius of fifty miles from Kampala. The assistance given by officers at Bukalasa and Serere Experimental Farms with observations on cotton insects has been of considerable use. An account of insects on cotton in Uganda has been prepared, and this should be published in 1930.

Other duties included mosquito investigations (handed over to the Medical Entomologist in June), a course of entomology for third year students from Makerere, and assistance to the Superintendent of Agricultural Education and the Medical Officer, Toro, in the preparation of syllabi for nature-study and biology. The records of Uganda mosquitoes, up to the time the Medical Entomologist took charge of the work, are to be published in the "Transactions of the Royal Entomological Society of Egypt."

5. Other investigational work has included sweet-potato insects, banana stem borer, various pests of maize, millets and other native food crops, and "rosette" disease of groundnut. The last-mentioned is transmitted by sucking insects, and the only feasible method of preventing serious damage by the disease appears to be the growing of varieties which are suited to the climate and soil.

6. Additional exhibits have been arranged in the Museum at the laboratory.

7. Flying swarms of the migratory locust *Schistocerca gregaria*, Forsk, were reported from almost all districts. The first reports came from the eastern and northern areas; later, the insects were seen in Buganda and Bunyoro, and finally the swarms spread as far south and west as Mbarara and Fort Portal. Very few swarms were reported after May. Comparatively little damage was done to crops.

At the end of February the Entomologist, in company with an Administrative Officer, visited Kenya to obtain full information concerning equipment and organisation for locust control; every assistance was given by Mr. Harrison and his staff.

Printed instructions for dealing with the pest were distributed throughout the Protectorate in February, and preparations were made for dealing with hopper swarms. Fortunately no breeding was observed excepting during May in Karamoja, where eggs were laid over a small area; the resulting hoppers were dealt with by the Kenya Locust Organisation, thus preventing migration to Kenya.

8. A paper on insect pests was read at the Annual Conference of the Uganda Planters' Association in June.

9. As in previous years, samples of seed from the worst quality cotton were obtained from all districts and examination for pink bollworm proved negative.

10. Specimens received for identification included: ticks, Tabanids, and various Muscid flies from the Veterinary Department; ticks from the Sanitary Inspector, Kampala; and various insects from the District Commissioner, Kigezi.

11. At the request of the Entomologist in Kenya a consignment of *Prorops nasuta*—parasite of the coffee berry borer—was sent in January to Nairobi.

Mr. A. Hempel, Entomologist to the Brazilian Government, visited the country for three weeks and succeeded in his attempt to transport alive for introduction into Brazil the above-mentioned coffee borer parasite.

12. Eighty-two packages of plants and seeds have been inspected during the year. The Bruchid beetle *Pachymerus longus*, Pic, was intercepted in seed from India.

13. The reference collection has received the necessary attention and a considerable number of named immature and adult specimens have been added. Insects or ticks have been presented by the following:—G. D. H. Carpenter, C. C. Chorley, A. Gedye, G. Gillanders, G. H. E. Hopkins, J. T. Kennedy, J. M. Wallace, and several members of the Agricultural Department.

14. The native artist has been fully occupied in making coloured drawings, rearing immature stages of insects and setting *Lepidoptera*.

15. Great assistance has been afforded by the staff of the Imperial Bureau of Entomology in the identification of insects; acknowledgment of similar assistance is also due to the following specialists:—M. Banninger, K. G. Blair, S. Breuning, W. E. China, H. L. Dozier, R. Frey, G. Horvath, V. Laboissiere, F. Laing, V. Lallemand, J. R. Malloch, E. Meyrick, F. Ohaus, A. d'Orchymont, M. Pic, and A. Thery.

16. The laboratory is indebted for entomological literature to the Governments of South Africa, Brazil, Jamaica, Java, Kenya, New Zealand, and of the United States, to the Government Entomologist, Sudan, and to the Indian Forest Research Institute.

H. HARGREAVES,

Entomologist.

ANNUAL REPORT OF THE BOTANIST.

Robusta Coffee.

The work of seed supply was continued. As far as possible seedlings from selected trees were issued and a record kept of the number of the selection distributed to each grower. No seed was selected or supplied in the Masaka district, as there has been no demand. However, trial quantities of seed have been supplied to two new areas—Bunyoro and Busoga—from which requests were received. In these cases the seed supplied was a bulked sample of about ten good trees, as one or two selections might not be suited to the locality. On the Sese Islands the seed from trees, previously selected, was sufficient to fulfil the requirements, particularly as natives have, in some cases, given preference to the wild ("native") coffee. In order to have small seedlings available at certain times of the year for distribution to outside nurseries, it has become necessary to store seed, so that these could be germinated when desired. The method of storage is given below.

2. Some trees were added to the selections previously made, but owing to the limited demand for seedlings it was unnecessary to make a large number of additional selections. A very important part of this work is to test the progenies of the best of these selections, which have, of course, been open-fertilized. If none of these progenies produce the uniformity desired we shall at least have material for further selection, and as they will be accessible, the trees could be self-fertilized, which is impossible at the present stage where practically all selections were made on native plots. A number of progenies have been transplanted in the nurseries at the Bukalasa Experiment Station, but they have not flourished. As previously reported, there are a very large number of types of robusta coffee, and though this has its advantages as well as disadvantages, it can be stated here that the evidence so far indicates that continued self-fertilization should yield, within a few generations, a fairly uniform progeny. This, at any rate, appears to be the case with the type of robusta which is rather similar to the ordinary "native" coffee. It might be stated, too, that a single selection was made of a very good tree of this latter type of coffee, which is favoured by the Sese Island natives, but so far the plants have not shown much promise.

3. The germination of robusta coffee seed in the nursery beds have received further attention, and some experiments are still in progress. Attempts to grow seed in dishes in the laboratory have failed on account of bacterial growth. Experiments in the nursery beds have shown that seed of which the parchment is removed commences to germinate a week or more earlier than seed on which the parchment is left, but so far it does not seem as if the unfolding of the first leaves are quite so successful in the case of the parchment-free seed. Various methods were tried to preserve the vitality of robusta coffee seed, which is soon lost, even if stored under laboratory conditions. Three lots of coffee from the same sample were treated in three different ways before storing, *viz.* :—

(a) After pulping, fermentation and washing, the cherry was put in the sun just to dry off all free moisture inside and outside the parchment.

(b) The same as (a) but dried for a longer period.

(c) The same as (a) but dried for a longer period than (b).

Coffee from all three lots were stored as follows:—(1) In moist charcoal; (2) in dry charcoal; (3) in a sealed container; (4) in the open in the laboratory. All seed from each lot was planted out after six months' storing and was grown in the same bed but the seed from each "method" was grown in three or four scattered rows. The only seed that germinated was that treated as under (a) and stored as under (2). Germination percentage was over 60. Unpulpd ("buni") coffee was stored in the laboratory for the same period but failed to germinate (after hulling). This is the method of storage now used, but the experiment is repeated. A test was also carried out to study the germination of "fresh" seed with various percentages of moisture. Seed with moisture percentages (on parchment free basis) of 52.1, 37.0, 21.1, 13.5 and 12.3 (the last for hulled "buni" coffee) gave, respectively, the following percentage germination: 71, 77, 91, 94 and about 98. Seven days elapsed between the dates of sowing of the first and the fourth lots, while the last lot was sown 18 days later than the fourth lot. Germination seems to be spread over a longer period in the case of seeds containing the higher percentage of moisture, that is, very fresh seed. An experiment to test out the effects of steeping coffee seed in warm and cold water on the evenness of germination, has shown (but not very conclusively) that germination is increased by soaking in water, although evenness appears not to be influenced. Seed should, however, not be soaked for too long periods as radicles protrude fairly soon and are liable to be rubbed off in sowing.

4. The biology of flowering is being studied a little, and in this connection various points have been under observation:—(1) The period that elapses before the stigma loses its power to produce germination of pollen: it seems that a style through which a pollen tube has passed dies away quicker than one through which no tube has passed. When flowers were pollinated 48 hours, 24 hours, and immediately after opening, it was found that the only seed set was in the case of flowers pollinated on the day of opening; (2) the time the pollen tube takes to enter the ovary: experiment has so far shown that under field conditions the period is not less than 24 hours; (3) the vitality of pollen in the field: it was found that vitality of pollen is retained at least 30 hours after opening of the anthers; (4) time taken for pollen to germinate: this period seems to be slightly longer under field conditions than artificial conditions (*see below*) and the pollen of the same flower on the same stigma is quite irregular as regards the time of germination; (5) opening of anthers and time of pollination: anthers open almost immediately after the flower opens, unless humidity is very high. No opening of anthers has yet been observed before opening of the flower. Pollination of the stigma under our conditions is entirely dependent upon wind and insects as flowers are not naturally self-pollinated; (6) agencies in pollination: both wind and insects, (perhaps mainly the latter) are responsible for pollination. The insects are almost entirely the honey bee and two other smaller (unidentified) bees. In one case the corollæ of 178 flowers were removed, and covered with mosquito netting, and only four seeds set in spite of the fact that a breeze was blowing all day and a number of other flowers surrounded these. When primaries are bagged, flowers on them set very poorly, even when the primaries are shaken; (7) the development of flower buds are also being studied (*see below*).

5. Studies carried out on the germination of pollen have produced the following results:—Sugar solution is quite a good medium for germinating pollen. Robusta coffee pollen will germinate in solutions ranging from pure water to about 35% cane sugar, or even higher, but best development has been obtained with a 7—12% sugar solution, for fresh pollen. Irregularities have however, occurred at various times in that per cent solutions which give good results at one time may not do so at another time, or even in the same test unexplainable irregularities have been noticed. The more concentrated solutions are generally very poor, giving rise to very irregular club-shaped tubes or plasmolysis. Pollen grains commence to germinate within one hour on artificial media, but the average period for pollen from the same anther is a good deal longer than this. When stored exposed to the atmosphere of the laboratory, pollen retains a high per cent vitality up to 96 hours from the morning on which the pollen was shed, but thereafter declines very rapidly. Of the various methods of storing pollen tried, it was found that in a desiccator the vitality was lost after seven days and seven nights. Pollen kept at room temperature or in a semi-humid atmosphere keeps almost as well. However, a repetition of these experiments has not given quite identical results. Pollen stored in the dark or in a very humid atmosphere or from flowers kept in water, has not given as good results.

6. Hybridisation work as reported for last year was continued. Many crosses between species were made, and although seed should now ripen, very few crosses have taken. It appears to be a mistake to attempt too many crosses on the same branch because a very small percentage of crosses are successful, with the result that the branch dies back as a small number of seeds is unable to draw a good flow of sap. A comparison was made between the method of removing whole corollæ or only the upper parts (on which the filaments of the stamens are inserted), and the results indicate that both methods are equally good for the purpose of removing anthers before hybridisation is done. Both of these methods are generally easier than that of removing individual anthers (or stamens) and certainly does not appear to be less efficient. Experiment has shown that self-fertilization in robusta is not easily accomplished unless mechanical measures are adopted in addition to the method of covering the flowers. Covering alone of individual branches with cloth "sleeves" has very little use; even shaking such covered branches is generally not much more effective. Bagging the whole or part of the tree, with brushing, has been attempted, but results are not yet available. In the case of the hybrids—labelled as *C. arabica* x *C. excelsa* and *C. arabica* x *C. robusta*—growing on the plantation and recorded as having been made by my predecessor, a good number of seeds (probably largely cross-

pollinated, by insects) have been collected and sown. Whereas last year very few seed have set, there are this year a fair number, and this should enable us to go a little further because these hybrid trees are themselves useless although vigorous and of a good habit of growth. Self-pollination and cross-pollination of these hybrids have given poor results.

7. On the problem of vegetative propagation very little has been done during the past year. As previously reported, *liberica*, *excelsa* and *robusta* will be compared as stocks for *robusta* coffee, but these plants have not attained the proper stage for grafting operations. Plants have been potted out in banana fibre pots for this work. This line of work is in more than one respect of immediate interest, *e.g.*, the question of increase of desirable selections and the use of uniform trees in trials of various kinds.

8. The measurement of growth of trees and the observations on the development of nodes and flower buds have now been continued for a period of one year. Records were kept of the monthly increase in height of the main stems of several trees as well as five to six "primary" branches on each tree. These branches or "primaries" were taken at intervals along the main stem of the trees. In addition to the monthly rate of growth, a monthly record was kept of node numbers, the stage of development of flowering buds, of flowering and of ripening of the berries. The rate of growth of the main stem is always exceeded by the rate of growth of the young primaries. There is a fairly close agreement between total rainfall and increase in length, when these values are plotted, but there are certain inconsistencies. These are, perhaps, only apparent because with monthly periods it is impossible to obtain overlapping everywhere as the influence of heavy showers are very marked and it might therefore be better to look upon this agreement of rainfall and growth as indirect; that is, it is perhaps largely a matter of soil moisture. For the sixth period the growth of trees shows an increase, whereas there was actually a decrease in the rainfall. The increase for this period was probably due to the heavy rainfall of 1.71 inches registered on the 17th of July.

9. The development of the flower bud is very irregular, depending on the type of tree, the amount of crop on the tree and the environmental conditions, mainly rainfall. Flowering itself will not take place below a certain minimum rainfall; that is, a minimum percentage of moisture in the soil is required. If this condition is not fulfilled, flower buds do not develop beyond a certain definite stage (just before flowering), until a good shower of rain falls, when further development is immediately resumed and brought to completion in a few days, when the flowers open. The period which elapses from the time a new node becomes visible on a primary, until the first signs of flower buds appear on the node, varies from about one month or slightly less to about four months or slightly more, the average period being one-and-a-half months. It should be mentioned, however, that the younger nodes of a primary sometimes develop buds before its older nodes. The period which a flower bud takes to develop (from the first signs of development until the opening of the flowers) has been found to vary from about nine weeks to as much as about 30 weeks and more, depending largely (it appears) on the crop. When development is stretched over long periods, the delay is generally due to a semi-dormant condition during the early stages of development of the bud rather than during the later stages. In the latter case, the delay appears to be due to unfavourable weather conditions. It is quite remarkable—and this is a common feature amongst *robusta* coffee types which flower only at certain definite periods and not after every good rain—how the groups of flower buds (at different nodes) which may differ in age as much as five months or more, may catch up with each other to flower all at the same time. Under such conditions, however, bud development proceeds in groups of the same age, as the nodes (of one and the same primary as well as all primaries of a tree) on which the buds show the same stage of development continue to show (until just before flowering), buds of the same stage of growth. The time from opening of the flower to the maturity of the berry has been found to vary from 10–11 months, with an average period of about 10½ months.

10. The experiment commenced, with the object of finding out the value of seedling characters in selection, is still in progress. In addition to the seedling characters the node numbers on which the first pair of "primaries" develop are being recorded for each plant. The plants from this experiment are from three selections, and they should not only give trees from which further selections could be made but should furnish useful material for other studies and observations.

11. Until breeding work has progressed far enough or until grafting has become a complete success, no experiments can be carried out on pruning, but the work previously reported has been continued. It has been found that if primaries are to be topped, in order to induce branching, this operation should be carried out when the primary is in vigorous growth (when not too old and preferably during the long rains) before the berries have developed to any size, and, if possible, before flowering.

The primary should not be cut back to a node bearing a crop of berries but to one which is young and quite close to the tip of the branch. The most important point at issue is: should the primaries of a tree be strengthened by inducing the development of secondary and tertiary branches, either by topping of the main stem or of the primaries themselves, where these do not develop naturally? No discussion is necessary, but it might be stated that the "primary" may be strengthened and its life prolonged indefinitely, so to speak, by proper handling. When the main stem of a tree has been topped there results a strengthening (increase in thickness) of primaries below, but this is not very noticeable much below about the fifth or sixth pair of "primaries" from the cut, so that if it is desired to strengthen all the primaries of a tree by this

means topping should be commenced while the tree is young, followed by later toppings at higher levels. The strengthening of a "primary" by topping appears to be an "indirect" effect of topping of the main stem as topping gives rise to secondary branches and the increased flow of sap, and/or a sap of a different composition brings about renewed growth (increase in thickness) in the "primary."

Fruit.

12. Except for a little budding of citrus trees no work was done on the vegetative propagation of stocks. Plants of various citrus fruits that may be of value as stocks, have been potted out, while others have been transplanted in a nursery, for purposes of budding. Plants of the common mango have also been potted out for grafting (inarching) on to superior kinds such as the "Bombay" mango introduced from Jamaica. The following citrus fruits have been introduced from South Africa and are now growing at the Bukalasa Plantation, at the Kampala Plantation and at the Botanical Gardens, Entebbe:—

Oranges: Golden Buck Eye, Du Roi, Valencia Late, Washington Navel, Pine Apple and Beauty of Glen Retreat.

Limes: West Indian and Tahitian.

Tangerines: Emperor, and an unnamed variety.

Grape fruit: Marsh's seedless.

From Jamaica were introduced the Royal and March's seedless grape fruits and an unnamed variety of tangerine, Star apple and Avocado pear, the latter having died in transit. From the Malay States was introduced seed of *Garcinia mangostana*, *Durio zibethinus* and *Achra sapota*, the latter having failed to germinate. From Ceylon were imported plants of *Aegle marmelos*, *Anona Cherimola*, *Anona squamosa* and *Artocarpus incisa*, the latter having died en route. Plants of three varieties of *Diospyros kaki* were also obtained from South Africa.

Oil Palm.

13. Since the beginning of 1928 when the first trees began to bear, yield records have been kept of all the oil palms growing at the Botanic Gardens, Entebbe. These were planted at a spacing of 10 by 20. Good seed was received from the Malayan Department of Agriculture in 1927, and the 14 plants which were obtained from these have been transplanted on the Kampala Government Plantation. A preliminary analysis of oil palm nuts has been made by the Chemist, and it is proposed soon to commence an analysis of the best yielders at Entebbe. In the meantime, however, seed of the three best yielders are being germinated to be planted out later at suitable distances, for further selection work.

Green Manure Plants.

14. From the Malayan Department of Agriculture small quantities of seed of *Centrosema plumieri*, *Calopogonium mucunoides*, *Indigofera anil* and *Crotolaria anagyroides* were obtained and were grown at the Bukalasa Government Plantation, along with *Crotolaria incana*, *Crotolaria intermedia* and *Phaseolus inamoensis* (Pois du Cap) from Scott Laboratories, Kenya. These have all grown well in the small plots where they were sown out. *Centrosema plumieri* has shown itself to be an excellent ground cover. Larger plots of these will be grown for further trial this season. In addition to the above, *Lupinus polyphyllus*, also from Scott Laboratories, has been grown for seed increase, and indigenous plants are also collected for trial: species of *Crotolaria*, *Indigofera*, *Eriosema*, etc.

Essential Oil Plants.

15. Introductions of plants and seed were made during the year. From the Amani Institute cuttings of *Pelargonium* spp. were forwarded, but these were dead on arrival. Plants of *Cymbopogon martini*, of *Vetiveria zizanioides* and of *Lippia citriodora* (one only) have also been received and are being established for trial. The *Cymbopogon* plants have, however, not survived the journey. From Ceylon, plants of *Pogostemon Patchouli* were introduced and have been rapidly increased. Further, seed of rosemary (*Rosmarinus officinalis*), lavender, and verbena were ordered from France but have failed to germinate except for lavender—but only after a second importation of seed was made. The following indigenous plants are also grown for trial: *Coleus* sp. (native name, "mubiri owomukyalo"), *Ocimum* sp. (native name: "Mujaja omuneni"), *Mochosma multiflorum* (native name: "Kawamala"), *Leonotis nepataefolia* (native name, "Kifumufumu"), another *labiate* (native name: "Kagogo").

Rubber.

16. All work in progress on these crops before the departure of Mr. F. W. Hall in July has been continued since then. The tapping of the 19 good yielders at the Kampala Government Plantation has now been carried on for two years. Of these trees, No. 22/70 has shown a remarkable increase over the 1928 yields, amounting to an average of over 11 ozs. per month—if the December yields are normal. Had selection been made at the end of 1928, this tree might not have received consideration, as it occupied 6th place. Three of the five best yielders (over

12½ lbs.) in 1929 were amongst the five best yielders of 1928. It is rather difficult to compare the yields of, say, the five best trees amongst the above 19 with the production from the best yielders in the East, but the highest yield above (about 20 lbs. per annum, if December yields are included) is certainly well below the figures recorded for the best yielders in the East.

Maize.

17. Eight varieties of maize, Muratha, Imperial White Dent, Chester County, Natal 8-Row, White Congo, Flat White, White Pearl, and Potchefstroom Pearl, were obtained from the Kenya Agricultural Department, and were grown in adjacent 0.35 acre plots at the Bukalasa Government Plantation. All varieties except Muratha and Flat White have succumbed to the leaf spot disease, and will, therefore, not be included in any further tests; White Pearl has, however, yielded well in spite of the heavy infection. These varieties have also been grown in isolation to keep the stock as pure as possible.

Miscellaneous.

18. The Bwamba area was again visited this year. The Bukalasa Government Plantation and the Botanic Gardens were also visited on several occasions. Various enquiries about crops were attended to. A number of plants were received for identification, while a large number of specimens (including many collected by other people) were also forwarded to Kew for identification. Partial lists of identifications have already been received from the Director, Royal Botanic Gardens, Kew, and for these we tender our best thanks.

L. C. C. LIEBENBERG,

Botanist.

ANNUAL REPORT OF MYCOLOGIST.

I was absent from the Protectorate on leave in England for the period April 13th to December 3rd. During my leave I attended the Conference of Empire Meteorologists held in London in August, and the Second Imperial Mycological Conference held in London in September. In addition, I spent a month at the Herbarium, Royal Botanic Gardens, Kew, and at the Imperial Bureau of Mycology, working on the fungi of Uganda.

2. In January a tour was made of some of the cotton areas of the Eastern Province, in connection with an outbreak of blackarm disease; and in February a tour was made of the coffee plantations of Toro district, accompanied by the Coffee Officer. In addition, visits were paid to some other European coffee estates, and to Lugazi sugar estate.

3. *Cotton*.—The epidemic of blackarm disease in the 1928-29 season was most serious in the northern parts of Teso, in some villages causing almost a total loss of crop. For the 1929-30 season these parts of Teso were supplied with seed from South Teso, where the attack of the disease had not been so severe. This present season reports from the Eastern Province indicate that the disease occurs over a considerably larger area than last year, being reported in quantity from Teso, Lango, and part of Busoga. Also the disease has appeared in serious form in the south of Buganda for the first time. Here it is most severe on cotton growing on light soil, though its distribution is not limited to this type of soil. In some plots on heavier soil the disease has caused great damage, but in many of these the cultivation of the plots was not as good as is usual. In the light of our present knowledge of this disease in Uganda and its relation to such factors as air temperature, soil temperatures, rainfall, humidity, soil types and soil conditions generally, it is not possible to lay down any definite rules or methods for avoiding it, and little can be done at present beyond selecting seed for the next crop from areas showing a minimum of infection. Even this selection of seed has to be qualified in order to keep costs of seed transport down to reasonable figures.

Work was continued during 1928-29 and 1929-30 cotton seasons on the transmission of *Nematospora gossypii* by *Dysdercus* spp. The results of the 1928-29 season indicate that cotton stainers of this genus, when bred in the laboratory on food containing no trace of *Nematospora*, are not associated with the fungus when transferred later to healthy cotton bolls. Such bolls, when examined two to three weeks later, show only the internal proliferation of the wall tissues, the lint remaining quite healthy. Additional evidence regarding the distribution of *Nematospora* in the field was obtained from the results of these experiments, in which, over a period of a

month when fed on cotton bolls in the field, the stainers were unable to pick up *Nematospora* and also the fungus was not found in the bolls used for the experiments; thus indicating that the fungus is not common on the external surface of cotton bolls, and that it does not as a rule grow through the punctures made by the insect in the boll wall. The washing of the bolls with $\frac{3}{4}$ % formalin solution in some of these experiments before feeding *Dysdercus* had no effect on the final result.

The full results from the experiments carried out during the present, 1929-30, season are not yet available, though preliminary indications are that nymphs of the early stages are not able to transmit the disease, after having been fed on a culture of *Nematospora*, whereas older nymphs and adult stainers are able to transmit the fungus from boll to boll.

No sign of the fungus has yet been found on or in the insect.

During the 1928-29 season the amount of internal bacterial rot of the cotton boll, as distinct from that due to *Nematospora*, showed a distinct increase over previous years. These bacterial rots often originate from the site of damage due to spiny bollworm (*Earias*); and also frequently from the sutures of the boll, which under some unknown conditions afford ingress into the lock to these pathogens.

4. *Coffee*.—No new disease of coffee has been found during the year, and few cases of disease have been reported.

One estate suffered from attack of the "Mealy Bug Root Disease" reported in earlier years; up to the present all attempts to reproduce this disease by inoculation have uniformly failed.

5. *Sugar*.—Mosaic disease remains our chief disease of this crop. During the year the recent importations of P.O.J. 213, 2,725 and 2,727 were supplied in quantity to the infected estate, and were planted in a nursery for propagation. Up to the present P.O.J. 2,725 appears the best of the three varieties under our conditions. P.O.J. 213 shows symptoms of Mosaic in a mild form, but the other two varieties have not shown any sign of the disease up to the present.

The "soft" canes recently imported from the West Indies have hitherto not done very well. In the estate nursery at Lugazi they have all contracted Mosaic disease, and most of them have suffered very badly from the effects of the disease, which appears to be more severe on these varieties than on Striped Ribbon, the chief estate variety. The varieties showing most promise are Ba 8,409, Ba 11,403; possibly BH (10) 12 and White Transparent are worth further trial.

As most of these varieties have proved to be so susceptible to Mosaic of a very severe type of infection, they are being discarded from our list. At present a small supply of P.O.J. 2,379 and 2,878 is awaiting despatch to Lugazi for estate trial.

6. *Maize*.—Streak disease is prevalent all over Uganda, but hitherto has not been found on sugar cane. The root rot due to *Gibberella saubinetii* has been found here for the first time on maize grown from seed imported from Kenya.

7. In conclusion, I have to thank the Director of the Imperial Bureau of Mycology, and the Director of the Royal Botanic Gardens, Kew, for help in all phases of my work, and, especially for facilities for working at these institutions in England; and especially Miss Wakefield, of Kew, and the whole staff of the Imperial Bureau of Mycology for most valuable aid in the identification of Uganda fungi and the preparation of a complete list of the fungi recorded here.

G. J. HANSFORD,

Mycologist.

ANNUAL REPORT OF THE AGRICULTURAL CHEMIST.

I have been on duty throughout the year. During August I made a tour of the Eastern Province to inspect the 100 acre clearings made under the Government scheme and to visit Departmental experiment areas. In September, Ankole and Kigezi were visited to discover if any steps had been taken by natives to check erosion, particularly the steep slopes in the latter district. Reports on these tours have already been forwarded. Except for a number of single day visits to European estates the remainder of the time has been spent in the laboratory. The total mileage covered on duty was 3,090.

Laboratory.—The following is a summary of the laboratory analytical work completed during the year:—

Soils	...	...	...	...	...	...	36
Foodstuffs	...	...	...	...	...	...	4
Poisons	...	...	...	...	...	...	2
Lime	...	...	...	...	...	...	2
Filter sand	} in connection with township water supply	...	...	...	...	...	{ 1
Chloride of lime							
Cinchona barks	...	...	...	...	...	...	6
Palm Oil extractions	...	...	...	...	...	...	4
Stone in Mvule	...	...	...	...	...	...	2
Alcohols	...	...	...	...	...	...	2

Soils.—The main soil type encountered is a heavy black-red loam overlying a very compact clay which grades into a layer of concretions of iron and silica. The depth of the latter layer varies from under a foot to over fifteen feet, and in places the intermediate clay horizon was missing, but the general soil type is the same. A typical mechanical analysis is given below. As this soil survey work is mainly technical and as there is insufficient staff to allow one to spend the whole time on it the detailed results cannot be published until the work is complete.

SAMPLE No. 143.

Depth of sample	...	...	0—6 inches	...	6—18 inches	...	over 18 inches.
Fine fractions—clay and silt	...	57.3	...	63.9	...	76.3	
Coarse fractions—sands	...	38.4	...	34.7	...	24.3	

Another soil type met on comparatively low lying land which has been under water in the past is a tightly compacted sand. The surface layer is grey-black in colour due to humus accumulation in the past. Underneath is a layer of yellow sand which, when dry, is more like a sandstone than a soil. This type has been noted particularly around Lakes Kioga (Usuku), Salisbury and George, and also on the Lake Victoria side of the Masaka—Bukoba road in Koki.

The only crop which is suited to this soil type is ground nuts which give quite good yields. More deeply rooting crops such as cotton fail owing to the fact that the subsoil is too compact for root spread. The dominant vegetation on this soil type is short grass, thin scrub, and in places the *Euphorbia candelabrum*.

It is significant that on each of these soil types a distinct hard-pan has been found relatively close to the surface, thus showing that their natural tendency is to pack tightly and so prevent adequate root penetration. The result is that the main tap root of both permanent and annual crops is stunted and the whole root system is found in the top foot of soil. The crop has no resistance to drought and is subject to attacks by disease and insects. European planters have been advised to subsoil, and soil samples have been taken to find if there is any chemical reason for this pan formation.

Soil Erosion.—Field observations, and the results of mechanical analysis, as reported above, have shown clearly that conditions on the slightest slope in most districts of the Protectorate are almost ideal for erosion. The fact that the subsoil is very compact means that all the rain in a heavy storm remains in the top few inches of soil and, once this is saturated, run-off starts and carries on down the slope with increasing velocity.

This will not be so serious in small native plots of an acre or less with uncleared land around, but it must be considered as a great potential soil deteriorant on larger clearings such as European owned estates and the 100-acre clearings in the Eastern Province.

The subject was discussed at the Agricultural Department Conference in April, and it was proved that terracing is the surest check and in spite of the high initial cost is less expensive than the construction and upkeep of contour drains or silt pits. Mr. Hall was able to produce the actual costs of construction of terraces on the Kampala Plantation compared with those of silt pits to hold the same rainfall. These costs are given in an appendix to this report.

As terracing is not applicable to native agriculture, an experiment has been planned to test the effectiveness of contour hedge crops and surface drains in checking erosion. This experiment is to be put down at Serere and if possible at Bukalasa in 1930.

Cinchona.—With a view to obtaining some idea as to whether varieties of cinchona would grow and give satisfactory yields in this country, seeds have been imported from time to time from India, Amani, and Java; these have been distributed among the Government plantations at Kampala, Entebbe, Bukalasa, Kakumiro, Fort Portal and Serere. In many cases germination was bad, but on some plantations small blocks have thrived.

This year samples of bark from six seven-year-old *C. ledgeriana* trees on the Forestry Plantation, Entebbe, have been extracted by the British Pharmacopœia method to obtain some data as to yield. Unfortunately the extracts were rather resinous and the amounts of total alkaloids insufficient to attempt a quantitative separation. Even allowing that the results may be rather high, the yields are very satisfactory as the British Pharmacopœia only demands a total alkaloid content of 5–6%.

Tree No.	...	...	1A	...	2A	...	3A	...	1B	...	2B	...	3B
Moisture %	...	...	65.5	...	74.0	...	41	...	55.7	...	63	...	48.9
Alkaloids % (calculated on dry bark)	...	...	13.0	...	17.5	...	17.2	...	11.2	...	13.7	...	14.7

This work is to be continued with samples of bark from all districts as the trees become old enough and by different methods of extraction to discover:—

- (a) Most suitable districts for Cinchona cultivation.
- (b) Best yielding trees for propagation.

Palm Oil.—As the oil palm *Elaeis guineensis* is indigenous in the Bwamba valley, in the Western Province, it is possible that it would provide an additional economic crop for native production in other parts of the Protectorate, particularly as the palms in the Botanic Gardens Entebbe, are fair yielders. No efforts had been made previously to discover the actual yield of oil so a few experimental extractions were carried out and showed a mean yield of 69% of oil expressed on dry pericarp. This is of the same order as the yield on the West Coast. Data as to the yield of fruits from individual trees are being collected to obtain a figure for the anticipated yield per acre. Further experimental work will be carried out to decide whether such an industry could prosper in Uganda in view of the extra freight charges to which the industry will be subject compared with that in West Africa, where almost all the oil palm cultivation is within twenty-five miles of the coast or river transport.

Essential Oils.—The department is indebted to Messrs. Lever Brothers for the presentation of an experimental still with boiler for the extraction of essential oils. Attempts to obtain seed of proved oil yielding plants have so far failed, no germination being obtained. Further supplies are on the way. The Botanist is also making a search to find indigenous plants likely to yield essential oils, and plots of such plants are being sown. The oils will be extracted and sent to England for valuation.

Stone in Mvule.—Holders of timber concessions in the Eastern Province frequently find large “stones” in the heartwood of the Mvule (*Chlorophora excelsa*). The stones make sawing dangerous, damage machinery and considerably reduce the value of the tree as timber. Two possible explanations are: (1) The stone had lodged in a fork and the tree had grown around it. (2) The stone had been formed at a wound in the young tree as a result of the drying out of the sap. To test these hypotheses, samples of the stone and sap were analysed with the following results:—

%	SiO ₂	Fe ₂ O ₃	CaO	CaCO ₃
Stone	0.676	0.046	13.24	23.65
Sap	0.237	0.154	0.037	

The high percentage of CaCO₃ rules out No. 1 as there is little natural stone of this type and the ratios $\frac{\text{SiO}_2 \text{ Stone}}{\text{SiO}_2 \text{ Sap}}$, $\frac{\text{Fe}_2\text{O}_3 \text{ Stone}}{\text{Fe}_2\text{O}_3 \text{ Sap}}$, $\frac{\text{CaO Stone}}{\text{CaO Stone}}$ are not of the same order so that something other than a simple drying out is indicated. As plantations of mvule are about to be started this problem is one of economic importance and further samples of stone and sap will be dealt with.

Education.—During the past year lessons in Agricultural Chemistry have been given to a class of five Makerere boys. They have shown extreme ability in memory feats but did not appear to be able to apply the knowledge thus obtained. No boy in the class showed enough regard for accuracy and detail to make him fitted to be accepted for training as a laboratory assistant. During the year they were tested with simple experiments in which accurate weighings and calculations were required, and no boy returned results within 5% of the true figure. In view of the results of these tests the course was varied to include more of the practical application of chemistry to agriculture than the analytical side.

Experimental and Advisory.—The manurial experiments on coffee, using artificials, have not been started during the year owing to the fact that members of the planting community were reluctant to undertake this type of work. To stimulate interest and to make the position more clear a paper on the "Science of Manuring" was read at the Annual Conference of the Uganda Planters' Association. The Director of Agriculture also discussed the position at a meeting of the Toro Planters' Association. As a result, plans have been made for experiments to be laid down early in 1930 in Toro, Bunyoro and Kyagwe, and it is hoped that the work will be extended later. Experiments with accurate costings on the effects of the grass mulch and the application of cotton seed are also to be desired to put all systems of manuring on an economic basis.

To supervise this work a member of the Chemical Section will endeavour to visit each estate at least once a year and all yield data and costings will be analysed statistically every year.

W. S. MARTIN,

Agricultural Chemist.

APPENDIX.

COST OF TERRACES AND SILT PITS ON THE KAMPALA PLANTATION.

BY MR. F. W. HALL, *Plantation Manager.*

Under the rubber near the nursery a small area has been treated, for demonstration purposes only, by methods that can be adopted to check or stop erosion under a permanent crop. The rubber I may mention is 19 years old and is planted in lines that do not conform to the contours, with the result that, to show properly the method of platform terracing, the contour could not be followed. In addition it made the other methods difficult to arrange.

As the labour had never previously undertaken the work of terracing it was to be expected that costs would be rather high, further, the slope, which varies from 1 in 3 to 1 in 7, makes terracing costs high, and as will be seen later, full terracing is too costly for the 1 in 7. The only reason why it was carried out on this plot was to have all methods as close together as possible for a demonstration plot.

(1) FULL TERRACING, *i.e.*, the back wall of one terrace forms the front of the next, with buttresses and catch pits.

Slope of land—1 in 7.

Terraces 16·3 ft. mean width.

14·5 ft. mean width to apex of slope.

1 in 10·5 mean back slope into hill.

523 ft. in length.

1/5th acre approximate.

Soil excavated	...	3,290 cubic feet	} × by 5 for amount per acre.
Capacity	...	5,308 " " "	

Rainfall capacity 7·3 inches per acre.

One man excavated and graded 52 cubic feet per day at 50 cents per man per day.

Costs are as follows :—

For 7·3 inches rainfall capacity :—

			<i>Shs.</i>	<i>cts.</i>	
Cost to level terraces	...	...	...	94	25 per acre.
" " excavate for 7·3 inches rainfall	...	...	...	63	90 " "
" " " per 1 inch rainfall	...	...	...	8	75 " "
Total costs	...	...	...	158	00 " "

*For 4 inches rainfall capacity :—*This is roughly the heaviest precipitation to be expected at any one time in Kampala. Estimated total cost, Shs. 129/25 per acre.

(2) PLATFORM TERRACES :—Trees 20 ft. by 20 ft. = 109 to acre. Slope 1 in 6.

Platform Terraces 9 ft. wide }
20 ft. long } to each tree.

1 in 6 back slope into hill.

Soil excavated per tree, 67·5 cubic feet = 7,358 cubic feet per acre.

Capacity per tree, 135 cubic feet = 14,717 cubic feet per acre.

Rainfall capacity, 4 inches per acre.

One man excavated and graded 61 cubic feet per day at 50 cents per man per day.

Cost is as follows :—

For 4 inches rainfall capacity :—Total cost Shs. 60/60 per acre.

It is to be noted that this system leaves a certain amount of land untouched which is open to erosion, though in the case of the latter the terraces collect both the soil and the water. In such platform terracing nearly two-thirds of the land is untreated. A certain amount of upkeep expenditure will be necessary to return soil washed on to the terraces.

(3) DEEP CATCH PITS, overlapping :—

Slope of land, 1 in 3

Pits, 22 ft. long, 2 ft. wide, 2 ft. 2 inches deep. 84 to the acre.

Rainfall capacity, 2·25 inches per acre.

One man excavated 62 cubic feet per day, at 50 cents per man per day.

Costs are as follows :—

For 2·25 inches rainfall capacity :—Total cost Shs. 66/- per acre.

For 4 inches rainfall capacity :—Estimated total cost Shs. 117/- per acre.

(4) SHALLOW CATCH PITS, overlapping land with much murram.

Slope of land, 1 in 6.

Pits, 35 ft. long, 2 ft wide, 1 ft. 6 inches deep. 64 to the acre.

Rainfall capacity, 1·8 inches.

One man excavated 56 cubic feet per day at 50 cents per man per day.

Costs are as follows :—

For 1 ft. 8 inches rainfall capacity :—Total cost Shs. 58/- per acre.

For 4 inches rainfall capacity :—Estimated total cost Shs. 129/- per acre.

It will be seen from the above figures that full terracing is too costly for such slopes, as excavation for levelling only is extremely high. Apart from this the depth from one terrace to the next is too great to allow a man to pass from one terrace to another without damaging them. A cover crop of *Centrosema pubescens* is to be established on the above area.

Platform terracing is the cheapest and the most suitable to adopt, though upkeep will be necessary.

(5) Passing to land of a more reasonable slope, *i.e.*, 1 in 13, the following data is available from a plot that is being terraced.

FULL TERRACING, with buttresses every 15 feet.

Slope of land, 1 in 13.

Terraces, 15 ft. wide.

1 in 18 approximate back slope into hill.

Soil excavated, 10,798 cubic feet per acre.

Capacity, 18,150 cubic feet per acre.

Rainfall capacity, 5 inches.

One man excavated and graded 74 cubic feet per day at 50 cents. per man per day.

Costs are as follows :—

For 5 inches rainfall capacity :—

			Shs.	cts.	
Cost to level terraces	...	...	42	30	per acre.
Cost to excavate for 5 inches rainfall	...	...	30	70	" "
Cost to excavate per 1 inch rainfall	...	...	6	14	" "
Total cost	...	...	73	00	" "

After levelling terraces it requires only an additional excavation of 907 cubic feet per acre to accommodate 1 inch rainfall, *i.e.*, the removal and grading of this amount gives a capacity of 3,630 cubic feet.

Upkeep costs will be practically nil after soil has consolidated.

For 4 inches rainfall capacity :—Estimated total cost, Shs. 66/86 per acre.

Supposing we wished to construct catch pits on this area and slope instead, and reckoning on a similar output per man, the following would be costs. Pits to be 2 ft. wide standard and 15 ft. apart.

For 5 inches rainfall capacity :—Required, 2,904 feet of pits, 2 ft. wide and 3 ft. 1 inch deep, approximate area taken up by catch pits 14%.

Excavation necessary, 18,150 cubic feet per acre.

Estimated cost, Shs. 122/50 per acre.

For 4 inches rainfall capacity :—Estimated cost, Shs. 98/- per acre. Upkeep costs for pits will be necessary.

In terracing there is always a loss of capacity through the fact that they cannot be constructed with geometrical exactitude, and this loss for the above-mentioned terraces will be about 10%.

These last figures show that on a reasonable slope terracing is much cheaper than catch-pitting, and for permanent crops such as rubber, coffee, cocoa, or tea it is the best method.

There is a serious drawback to terracing where annual crops are to be grown. Terracing means an exposure of a good deal of subsoil, unless the surface soil is removed, the subsoil graded, and the former returned, a very expensive method. With permanent crops, holes can be dug and filled with surface soil to overcome this drawback, and by the time these crops have spread their roots into the surrounding subsoil it has gained some fertility through exposure, cultivation and addition of humus.

Catch pits, on the other hand, would be difficult for a native to construct, as his main weapon is the hoe. Apart from this they will not stop wash, while terraces will.

F. W. HALL,
Plantation Manager.

APPENDIX No. 1.

EMPIRE COTTON GROWING CORPORATION.

Report on sample of cotton from Bukalasa Plantation.

PRELIMINARY EXAMINATION.

Reference No. of Sample.	Type of Cotton.	Grade and remarks on Colour.	Length of Staple. (Fractions of an inch.	Strength of Staple. (Weak, medium, strong or very strong).	Quality and Character of Staple. (Lustre, fineness, etc.).	Order of merit. (Judged on intrinsic qualities, without reference to amount of dirt, leaf, etc.).
S.G. 29 ...	American seed.	Strict good middling, rather high colour.	Full, 1 $\frac{1}{8}$ " ...	Medium ...	Fairly lustrous and fine.	11'15d.
Local (Bulemezi).	do	Strict good middling, creamy colour.	Good, 1 $\frac{1}{8}$ " ...	Strong ...	do ...	10'95d.
S.G. 15 ...	do	do ...	1 $\frac{1}{8}$ "—1 $\frac{3}{16}$ " ...	Strong ...	do ...	11'35d.
S.G. 26 ...	do	Good middling, high colour.	Full 1 $\frac{1}{8}$ ", rather wasty	Strong ...	do ...	11'05d.

Based on October American Futures—9'55d.
Middling American ... —9'90d.

(Signed) WOLSTENHOLME AND HOLLAND.

Date: 29th October, 1929.

Native Agriculture—Estimate of Approximate Acreages of Crops under Cultivation 1929.

Province and District.	Plantains.	Potatoes.		Millets.		Cotton.	Coffee.		Para Rubber.	Simsim.	Ground Nuts.	Chil- lies.	Maize.	Rice.	Wheat.	Beans.	Peas.	Tob- acco.	Sugar Cane.	Cassava.	Miscel- laneous Crops.
		Sweet.	English.	M'tama.	Winbli.		Robus- tica.	Ara- bica.													
ACRES.																					
BUGANDA:—																					
...	292,495	52,355	466	2,643	12,932	96,093	1,500	163	100	6,816	10,800	170	32,561	107	...	26,179	681	500	1,690	48,967	500
...	84,043	32,106	834	2,440	...	47,299	2,200	268	17	1,152	2,168	40	13,659	24	...	15,158	116	300	1,241	17,556	...
...	60,000	4,500	50	3,000	500	28,000	3,900	2,300	50	150	3,000	500	2,000	...	...	2,000	500	20	...	2,500	...
...	32,000	45,383	885	2,804	10,746	27,643	800	200	80	3,955	3,015	62	10,156	...	...	10,580	80	1,334	436	40,989	...
TOTAL		468,538	134,344	10,887	24,178	199,035	8,400	2,926	247	12,073	18,983	772	58,876	181	...	53,917	1,377	2,154	3,367	110,012	500
EASTERN PROVINCE:—																					
...	150,000	36,600	...	15,000	100,000	111,324	...	...	...	3,700	5,700	450	21,249	5,600	...	28,800	...	50	200	10,000	...
...	16,500	9,640	...	5,542	35,797	33,814	...	...	...	2,826	3,467	14	4,185	5,224	...	3,700	...	10	35	7,000	...
...	22,000	40,222	...	5,430	60,000	77,038	...	...	...	8,800	7,900	...	9,100	8,376	...	5,800	...	...	21	9,900	...
...	47,000	14,943	...	2,764	21,644	33,041	...	1,380	...	881	1,554	55	6,150	3,915	...	5,756	...	...	...	8,570	...
...	1,500	40,616	...	27,300	97,000	107,670	...	...	...	16,000	21,746	47	2,000	1,108	...	15,613	...	10	...	35,310	225
...	680	33,492	...	33,957	87,596	57,015	...	...	...	47,211	18,811	...	3,749	27	...	4,193	62,658	...	...	23,807	...
...	...	400	...	13,000	1,000	...	...	...	...	400	500	...	10	...	...	100	...	500	...	10	...
TOTAL		237,680	175,913	102,993	403,037	419,902	...	1,380	...	79,818	59,678	566	46,443	24,250	...	63,962	62,658	570	274	94,597	225
NORTHERN PROVINCE:—																					
...	8,000	14,000	50	1,000	15,000	15,600	70	210	...	8,000	1,200	5	1,000	6	...	10,000	700	430*	50	1,000	500
...	20	7,170	5	9,000	18,000	17,000	...	...	...	20,000	2,750	...	200	30	...	2,750	...	...	...	7,000	...
...	...	4,000	...	...	70,000	6,800	...	...	...	50,000	600	...	150	...	...	30	...	...	...	500	...
...	70	33,500	12	72,300	80,400	100	1	6	...	45,400	580	5	110	100	...	25,200	12,100	...	100	2,800	...
TOTAL		8,090	58,670	82,300	183,400	39,500	71	216	...	123,400	5,130	10	1,460	136	...	37,980	12,800	430	150	11,300	500
WESTERN PROVINCE:—																					
...	55,000	16,028	120	3,900	5,000	3,100	2,500	83	...	50	589	5	1,050	38	160	2,000	10	10	120	4,240	5
...	31,000	15,500	50	4,650	34,800	1,720	...	721	...	5	500	10	2,300	...	2	15,500	9,300	200	5	250	100
...	8,000	27,505	50	25,059	30,710	...	...	91	...	50	50	100	24,150	...	10	21,256	23,683	100	10	100	...
TOTAL		94,000	59,033	33,609	70,510	4,820	2,500	895	...	105	1,139	115	27,500	38	172	38,756	32,993	810	135	4,590	105
GRAND TOTAL		808,308	427,960	229,789	681,125	663,257	10,971	5,117	247	215,396	84,930	1,463	133,779	24,555	172	194,615	109,828	3,464	3,926	220,499	1,330

*280 acres fire cured tobacco. All other tobacco acreages cured by native methods.
TOTAL 3,823,553 Acres.

Livestock—1929.

PROVINCE AND DISTRICT.				Cattle.	Mules.	Asses.	Sheep.	Goats.	Swine.
BUGANDA :—									
Mengo	...	...	...	54,501	6	15	25,536	188,874	172
Entebbe	...	...	...	27,024	—	3	9,383	64,728	139
Masaka	...	...	...	101,921	1	5	12,644	52,935	35
Mubende	...	...	...	27,488	—	2	10,709	95,952	12
TOTAL				210,934	7	25	58,272	402,489	358
EASTERN :—									
Busoga	...	...	...	93,708	—	6	35,453	219,089	—
Bugwere	...	...	...	75,256	—	—	17,535	111,110	—
Bugishu	...	...	...	149,130	1	15	55,401	147,055	7
Budama	...	...	...	73,890	—	—	17,180	46,527	15
Teso	...	...	...	251,543	—	64	41,367	100,780	82
Lango	...	...	...	251,991	—	2	73,740	125,200	—
Karamoja	...	...	...	150,000	3	15,000	160,000	85,000	—
TOTAL				1,045,518	4	15,087	400,676	834,761	104
NORTHERN :—									
Bunyoro	...	...	...	4,005	4	4	10,972	42,479	7
Gulu	...	...	...	44,566	1	9	16,547	38,203	2
Chua	...	...	...	26,500	1	10	21,400	29,300	—
West Nile	...	...	...	115,869	6	8	47,278	141,233	5
TOTAL				190,940	12	31	96,197	251,215	14
WESTERN :—									
Toro	...	...	...	78,339	—	23	41,357	87,204	30
Ankole	...	...	...	166,817	—	4	119,544	207,036	—
Kigezi	...	...	...	216,986	—	2	89,787	136,096	20
TOTAL				462,142	—	29	250,688	430,336	50
GRAND TOTAL				1,909,534	23	15,172	805,833	1,918,801	526

Horses : Mengo District—3.

The above figures include Livestock on European and Asiatic Plantations.

European Agriculture, 1929.

COMPILED FROM RETURNS FROM 220 PLANTATIONS.

Province and District.	Number of Estates.	Total Acreage taken up.	Total acreage cultivated.	COFFEE.		Para Rubber, Acres.	Tea, Acres.	Cotton, Acres.	Tobacco Acres.	Maize, Acres.	Miscellaneous, Acres.
				Arabica, Acres.	Robusta, Acres.						
BUGANDA—											
Mengo ...	77	37,636	12,111	2,959	3,358	7,453	35	193	331	28	...
Entebbe ...	18	6,793	2,418	556	485	1,397	80	46	8	...	15
Mubende ...	14	8,851	2,239	1,470	330	484	206	...	...	15	...
Masaka ...	20	7,055	1,754	1,141	392	365	...	...	...	140	...
TOTAL ...	129	60,335	18,522	6,126	4,565	9,699	321	239	339	183	15
EASTERN—											
Busoga ...	8	9,188	768	565	158	50	...	15	...	...	30
WESTERN—											
Toro ...	60	25,575	4,116	4,016	61	...	21	8	...	4	100
NORTHERN—											
Bunyoro ...	23	12,889	3,438	2,261	544	999	...	...	29	71	165
GRAND TOTAL...	220	107,987	26,844	12,968	5,328	10,748	342	262	368	258	310

3,740 acres interplanted with various crops included in above.

Returns not received from six estates, figures for which have been taken from previous returns and included in above.

Includes twelve estates comprising 4,472 acres totally undeveloped.

Excludes seventeen estates, returns for which have not been received and are presumed abandoned.

Asiatic Agriculture, 1929.

COMPILED FROM RETURNS FROM 38 PLANTATIONS.

Province and District.	Number of Estates.	Total Acreage taken up.	Total Acreage cultivated.	COFFEE.		Para Rubber, Acres.	Sugar Cane, Acres.	Cotton, Acres.	Miscellaneous, Acres.
				Arabica, Acres.	Robusta, Acres.				
BUGANDA—									
Mengo ...	14	12,935	5,567	170	482	650	4,675	—	10
Entebbe ...	6	1,880	223	88	—	75	60	—	2
Mubende ...	3	1,525	212	200	—	10	—	—	—
Masaka ...	3	1,764	440	5	60	170	170	30	17
TOTAL ...	26	18,104	6,442	463	542	905	4,905	30	29
WESTERN—									
Toro ...	2	584	74	74	—	—	—	—	—
NORTHERN—									
Bunyoro ...	1	100	5	—	—	—	—	—	5
EASTERN—									
Busoga ...	9	7,744	1,245	225	125	800	95	—	—
GRAND TOTAL ...	38	26,532	7,766	762	667	1,705	5,000	30	34

432 acres interplanted with various crops included in above.

Returns not received from 16 estates, figures for which have been taken from previous returns and included in above.

Includes 11 estates comprising 4,479 acres totally undeveloped.

APPENDIX No. 6.

COMPARATIVE STATEMENT OF UGANDA PRODUCE EXPORTED FROM MOMBASA FOR THE YEAR ENDED 31ST DECEMBER, 1929.

ARTICLES.	Unit.	From 1st January to 31st December, 1929.		From 1st January to 31st December, 1928.		INCREASE.		DECREASE.	
		Quantity	£	Quantity	£	Quantity	£	Quantity	£
Cotton, Raw ...	centals	816,228	3,312,667	553,944	2,475,327	262,284	837,340	...	...
Cotton Seed ...	tons	67,523	424,000	45,506	323,110	22,017	100,890	...	...
Coffee, Hulled ...	cwts.	34,626	155,298	...	...	...	...	...	...
" Parchment ...	"	5,996	20,552	40,355	164,187	837½	12,955	...	...
" Unhulled ...	"	570	1,286	...	...	...	...	...	...
" Prepared ...	"	½	6	...	...	...	...	...	...
Rubber, Plantation ...	centals	8,231	28,818	11,312	54,978	...	...	3,081	26,160
Tobacco, Unmanufactured ...	lbs.	61,967	3,040	8,539	327	53,428	2,713	...	...
Tobacco, Cigarettes ...	"	114	26	...	...	114	26	...	...
Chillies ...	cwts.	6,174	26,133	4,437	25,848	1,737	285	...	...
Jaggery, Unrefined Sugar ...	"	97	103	125	130	...	...	28	27
Sugar, Refined ...	"	4,276	7,071	2,749	4,434	1,527	2,637	...	...
Ground Nuts ...	tons	316	5,419	150	2,636	166	2,783	...	...
Cacao, Raw ...	cwts.	4	12	2	6	2	6	...	...
Simsim, Seed ...	tons	1,388	24,890	115	2,162	1,223	22,728	...	...
Simsim, Oil ...	Imp. gls.	1,678	464	1,536	422	142	42	...	...
Ghee (Clarified Butter) ...	cwts.	62	475	31	239	31	236	...	...
Oil Seed Cake ...	tons	74	495	136	847	...	...	62	352
Skins, Sheep and Goats ...	No.	258,045	12,901	163,042	8,039	95,008	4,862	...	...
Skins, Miscellaneous ...	"	78	49	202	14	...	35	124	...
Hides, Dry and Dry Salted ...	cwts.	35,099	152,542	58,677	257,288	...	...	23,578	104,746
Ivory ...	"	407	24,757	329	21,759	78	2,998	...	...
Hippo Teeth ...	"	2½	17	1	4	1½	13	...	...
Horns ...	lbs.	231	639	336	722	...	...	105	83
Tin Ore ...	tons	324½	63,900	252	50,673	72½	13,227	...	...
Other Ores ...	"	4½	271	...	...	4½	271	...	...
Methylated Spirits ...	Imp. gls.	1,418	287	548	94	875	193	...	...
Rectified Spirits ...	"	174	39	...	...	174	39	...	...
Timber ...	cu. ft.	3,533	1,161	2,283	609	1,250	552	...	...
Maize ...	cwts.	9,925	3,882	...	...	9,925	3,882	...	...
Maize Meal ...	"	888	468	...	...	888	468	...	...
Tea ...	"	12½	133	...	...	12½	133	...	...
Goods manufactured, unenumerated	value	...	957	...	309	...	648	...	...
Goods unmanufactured, unenumerated	"	...	781	...	293	...	488	...	...
Miscellaneous Exports ...	"	...	1,216	...	810	...	406	...	...
TOTAL ...			4,274,755		3,395,267		1,010,856		131,368

Net Increase :— £879,488.

Comparative Statement of Exports from the Uganda Protectorate.

ARTICLES.	Unit.	Year ended 31st December, 1925.		Year ended 31st December, 1926.		Year ended 31st December, 1927.		Year ended 31st December, 1928.		Year ended 31st December, 1929.	
		Quantity.	£	Quantity.	£	Quantity.	£	Quantity.	£	Quantity.	£
Cotton, Raw	Centals	784,152	4,685,992	723,438	3,051,791	526,911	1,690,838	553,944	2,475,327	816,228	3,312,667
" Seed	Tons	21,928	122,790	35,360	194,887	29,500	170,303	43,506	323,110	67,523	424,000
Coffee, Raw	Owls.	29,883	139,469	33,211	147,884	43,544	170,407	40,355	164,187	...	...
" Hulled	"	...	...	...	...	...	...	...	...	34,626	155,298
" Parchment	"	...	...	...	...	...	...	...	...	5,996	20,552
" Unhulled	"	...	...	...	...	...	...	...	...	570	1,286
" Prepared	"	...	...	...	...	...	...	...	...	...	6
Rubber, Plantation	Centals	8,058	68,704	13,561	135,619	14,403	82,077	11,312	54,978	8,231	28,818
" Wild	lbs.	...	...	...	...	33	84	...	...	...	...
Tobacco, unmanufactured	"	...	...	...	...	...	...	8,539	...	61,967	3,040
" Cigarettes	"	...	...	...	...	...	...	...	...	114	26
Chillies	Owls.	2,957	2,935	1,245	1,715	1,308	4,359	4,437	25,848	6,174	26,133
Jaggery (unrefined sugar)	"	368	245	272	215	436	425	125	130	97	103
Sugar, refined	Tons	4,053	7,447	3,800	1,599	10,161	13,371	2,749	4,434	4,276	7,071
Groundnuts	"	41	820	380	6,026	2	40	150	2,636	216	5,419
Cacao, Raw	Owls.	115	311	10	18	64	160	2	6	4	12
Simsim Seed	Tons.	214	4,523	194	4,130	718	13,732	115	2,162	1,358	24,890
" Oil	Imp. Galls...	...	...	...	...	88	25	1,536	422	1,678	464
Ghee (clarified butter)	Cwts.	...	...	...	...	...	...	31	239	62	475
Oil Seed (ake	Tons	...	...	...	...	...	...	136	847	74	495
Skins, Sheep and Goat	No.	55,350	4,014	88,750	5,173	78,411	4,091	163,042	8,039	258,045	12,901
Miscellaneous	"	...	...	...	...	...	...	202	14	78	49
Hides, dry and dry salted	Cwts.	7,027	29,843	7,640	27,357	129,619	99,541	58,677	257,288	35,099	152,542
Ivory	"	307	28,535	202	18,289	499	34,574	329	21,759	407	24,757
Hippo Teeth	lbs.	1	86	10	86	2	15	1	4	28	17
Horns	Tons	112	86	448	346	448	453	336	722	251	639
Metaliferous ores, non-ferrous	"	...	...	...	...	117½	20,875	252	50,673	...	...
Tin Ore	"	...	...	...	...	...	...	...	...	324½	63,900
Other Ores	"	...	...	...	...	638	...	...	...	4½	271
Methylated Spirits	Imp. Galls...	...	...	...	...	...	96	543	94	1,418	287
Rectified	Cub. ft.	359	...	5,144	1,703	4,637	917	2,283	609	174	39
Timber	Cwts.	...	...	...	...	...	...	...	...	3,533	1,161
Maize	"	...	...	...	...	...	...	...	...	9,925	3,882
Maize Meal	"	...	...	...	...	...	...	...	...	888	468
Tea	Value	...	53	...	177	...	162	...	...	12½	133
Goods, manufactured, unenumerated	"	...	345	...	82	...	62	...	...	...	957
" unmanufactured	"	...	521	...	340	...	653	...	...	...	781
Miscellaneous Exports	"	...	...	...	...	...	...	...	...	...	1,216
TOTALS	—	...	5,096,717	...	3,597,437	...	2,310,260	...	3,895,267	...	4,274,755

Details of Machinery at Ginneries in the Uganda Protectorate—1929 Season.

PROVINCE AND DISTRICT.	GINNERIES.				GINS.				SEED OPENERS.				PRESSES.				ENGINES.				DELINTERS.				
	Working.		Silent.		Roller.		Saw.		Working.		Silent.		Working.		Silent.		Power.		Steam.			Oil.		Suction Gas.	
Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.	Working.	Silent.		
EASTERN :—																									
Busoga	22	*14	300	91	4	13	22	9	8	14	14	...	19	8	4	5	...	...	...	...	...	...	...	...	
Budama	7	...	42	...	24	...	3	...	6	...	...	...	3	...	2	...	...	...	...	...	...	...	...	...	
Buwere	11	2	97	18	21	3	8	2	7	3	5	1	6	1	3	...	...	...	...	...	...	...	...	...	
Bugishu	4	...	49	...	2	...	4	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Teso	21	*4	243	31	9	4	21	3	9	5	15	1	9	2	...	...	...	...	...	...	...	...	...	...	
Lango	14	*2	136	10	3	5	13	1	6	2	10	...	11	1	...	...	...	...	...	...	...	...	...	...	
TOTAL	79	22	867	150	63	25	71	15	37	24	55	2	51	12	9	8	...	...	...	...	...	...	...	...	
BUGANDA :—																									
Mengo	35	10	449	87	...	4	36	9	9	7	23	4	21	7	6	2	...	...	...	...	...	...	...	...	
Entebbe	10	1	108	8	4	...	11	1	3	1	7	...	9	1	1	...	...	...	...	...	...	...	...	...	
Masaka	8	2	110	10	...	2	8	1	...	...	8	...	7	2	1	...	...	...	...	...	...	...	...	...	
Mubende	9	3	102	17	...	3	9	2	8	3	1	...	9	2	...	...	...	...	...	...	...	...	...	...	
TOTAL	62	16	769	122	4	9	64	13	20	11	39	4	46	12	8	3	...	...	...	...	...	...	...	...	
NORTHERN :—																									
Bunyoro	2	*3	22	20	2	2	2	2	...	2	2	1	2	2	...	1	...	...	...	...	...	...	...	...	
Gulu	4	...	42	...	...	...	4	...	2	...	2	...	4	...	...	...	...	...	...	...	...	...	...	...	
Chua	1	...	12	...	...	...	1	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
West Nile	1	...	...	...	3	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	
TOTAL	8	3	76	20	5	2	7	2	3	2	5	1	8	2	...	1	...	...	...	...	...	...	...	...	
WESTERN :—																									
Toro	1	...	6	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
Ankole	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
TOTAL	1	1	6	...	...	1	1	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	
GRAND TOTALS	150	† 42	1,718	292	72	37	143	30	60	37	99	7	106	27	17	12	30	2	...	...	...	...	...	...	
	192		2,010		109		173		97		106		133	29			32							3	

NOTE :—* Includes one licensed but silent. † Includes three licensed but silent.

LIST OF CIRCULARS OBTAINABLE FROM THE DIRECTOR OF AGRICULTURE, ENTEBBE.

-
- No. 2.—COTTON CULTIVATION.
- No. 3.—DISEASES OF *Hevea brasiliensis* IN UGANDA.
- No. 4.—DIE-BACK OF *Coffea arabica* IN UGANDA.
- No. 7.—REPORT ON COFFEE CULTIVATION IN UGANDA.
- No. 8.—DISEASES OF CEREALS IN UGANDA.
- No. 9.—DISEASES OF *Coffea arabica* IN UGANDA.
- No. 13.—COFFEE BUG (*Antestia lineaticollis* STAL.,
VAR.).
- No. 14.—COFFEE ROBUSTA IN UGANDA.
- No. 15.—CULTIVATION AND PREPARATION OF COFFEE
ROBUSTA.
- No. 16.—COTTON EXPERIMENTS 1925-26.
- No. 17.—(A) THE OCCURRENCE OF ANGULAR LEAF-SPOT
OF COTTON IN UGANDA.
(B) ROT OF HEVEA CORTEX IN UGANDA.
- No. 18.—RUBBER EXPERIMENTS ON THE GOVERNMENT
PLANTATION, KAMPALA.
- No. 19.—SUGAR CANE IN UGANDA.
- No. 20.—NOTES ON THE CULTIVATION, CURING AND
PACKING OF FIRE-CURED TOBACCO.
- No. 21.—SOIL MANAGEMENT AND MANURING.
- No. 22.—VARIEGATED COFFEE BUG (*Antestia* spp.).

Showing Average Annual
Rainfall in Inches

Boundaries, Protectorate.....

do, District.....

Other Meteorological Stations • Rudo

F. C. MacDonald, Uganda Survey Dept.
July 1925.

